Obturator Fabrication and Management for Velopharyngeal Insufficiency

Steve Tseng

A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Science in Dentistry

University of Washington

2013

Barbara Sheller

Linda Eblen

Elizabeth Velan

Program Authorized to Offer Degree:

Pediatric Dentistry

University of Washington

Abstract

Obturator Fabrication and Management for Velopharyngeal Insufficiency

Steve Tseng

Chair of the Supervisory Committee:

Barbara Sheller

Department of Pediatric Dentistry

Purpose: Describe all patients referred for obturators to manage velopharyngeal insufficiency from January 1, 2001 to November 30, 2012 at Seattle Children's Hospital, looking at the following parameters of interest: demographics, medical diagnoses, surgical history, speech assessments and interventions, clinical course with obturator, and speech outcomes, and to explore variables which may predict success or suboptimal outcome with the pharyngeal obturator such as patient age, size of anatomic defect, degree of VP sphincter muscle function, or co-occurring medical diagnoses.

Methods: This descriptive study involves a chart review of all patients who have undergone obturator fabrication at Seattle Children's Hospital from January 1, 2001 to November 30, 2012.

Results: A total of 28 patients (13 males and 15 females) were managed in the obturator program over the study period. Most patients in this study are still active

(67.8%); among active patients 75% are growing, and 25% have finished growing. Nine patients who are no longer active discontinued treatment due to: family decision (N=3), family move (N=2), VPI surgery (N=2), alternate therapy (N=1), or uncooperative behavior (N=1). Obturators resulted in improved speech for 92.9% (N=26) of patients with full resolution in 50.0% (N=14). Most patients in the obturator program had severe VPI (57.1%, N=16), while the remaining were moderate (14.3%, N=4) and mild (14.3%, N=4), with four patients uncategorized. The highest comorbidity for VPI was a craniofacial diagnosis (62%), with the most prevalent diagnoses being cleft palate (24%) and cleft lip and palate (14%). Obstructive sleep apnea (26%) and dysarthria (19%) were the most common non-craniofacial comorbidities.

Conclusions: Wearing an obturator did not stimulate VP muscle function to eliminate or decrease VPI. Obturator management of VPI should be viewed as an ongoing treatment modality. The majority of patients with obturators were still in active status, even after craniofacial growth was complete. The best results were achieved in patients with an anatomical defect without intellectual disability. The patients with less successful outcomes were those with dysarthria, facial nerve weakness, intellectual disability, and mitochondrial cytopathy.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

I would like to extend my deep gratitude and respect to my research committee for all of their insight, guidance, and support throughout this process. It has been a great privilege to work with everyone involved, and I cannot express how much I appreciate all of their endless efforts and dedication. I would like thank Linda Eblen for taking the time to explain the complexities of speech-language pathology and allowing us to leverage her expertise. Thanks to Dr. JoAnna Scott for being available as an invaluable resource. Special thanks to Dr. Barbara Sheller and Dr. Elizabeth Velan for their helpful and encouraging emails, prompt replies, and their boundless energy and enthusiasm during our early weekend morning meetings to make all this possible.

DEDICATION

To my family for their understanding, patience, and unwavering support, to Vivian for your perseverance, strength, and compassion, to my fellow residents for making the last two years an unforgettable experience of growth, joy, and discovery, and in loving honor and memory of my father for all his inspiration and values that continue to last to a lifetime. You all have made me a better person and hold me to the highest standards to achieve - thank you for everything.

INTRODUCTION

An important prerequisite for intelligible speech is appropriate separation of the nasopharynx from the oropharynx, by the contact of the soft palate with the lateral and posterior pharyngeal walls. The soft palate elevates and extends to contact the posterior pharynx as concomitant narrowing of the pharynx occurs with forward and mesial movement of its walls (Willging et al, 2003) (Figure 1a). The velopharyngeal (VP) mechanism is innervated by cranial nerves V (trigeminal), VII (facial), IX (glossopharyngeal), and X (vagus).

Velopharyngeal insufficiency (VPI) results from the inadequate closure of the VP mechanism during speech, allowing air to escape through the nose instead of passing through the mouth (Figure 1b). Nasal air escape can manifest in different ways in different individuals depending on the air leakage gap size and each person's accommodation to the problem. Speech can sound muffled and intelligibility can be mildly-to-severely impaired. Two main characteristics of VPI are nasal air escape, sometimes occurring as nasal snorting, and hypernasal resonance. Nasal snorting occurs on pressure consonants (p, b, t, d, k, g, f, v, th, s, z, sh, zh, ch, j) as air vibrates through an almost closed velopharynx. Hypernasal resonance occurs on vowel sounds and the vocalic consonants (w, y, l, r) and can be mild to severe. Facial grimacing can occur in patients with VPI as a subconscious attempt to assist with VP closure.

There are many syndromes and conditions that may result in VPI. Cleft palate, both before and after repair, is the most common cause of VPI, occurring in 20% to 30% of

children with clefts (Conley et al, 1997). Factors including the type of cleft, age at surgical repair, surgical technique, and abnormal pharyngeal musculature may influence the incidence of VPI following cleft palate repair (Conley et al, 1997; Persson et al, 2002). VPI occurs in a small percentage of children with submucous cleft palate or after adenoid removal (Conley et al, 1997; Willging et al, 2003; Witzel et al, 1986). Traumatic brain injury involving cranial nerves V, VII, IX, or X can also result in VPI.

The primary diagnosis of VPI is established with perceptual speech assessment performed by a speech-language pathologist (SLP) with expertise in VPI assessment (Conley et al, 1997). Other assessments can assist with the diagnosis and help determine management options. Numerical measures have been created to quantify a patient's VPI severity. Nasometry scores measure the ratio between nasal and oral airflow. The values can be compared with normalized values for certain phrases; however, it is not descriptive of VPI severity (Conley et al, 1997; Hardin et al, 1992).

Nasopharyngoscopy (NP) allows a direct view of the VP sphincter. The relative size and location of the defect can be determined, as well as anatomic landmarks to define the level of VP closure (Conley et al, 1997). Frontal and lateral speech videofluoroscopy views of the VP mechanism can confirm the level of attempted VP closure and reveal occasional compensatory posterior tongue elevation as a VPI compensatory technique.

VPI management is based on patient history, VPI evaluation results, treatment recommendations, and family preference. Management can include speech therapy, surgery, or a prosthetic speech appliance.

Speech therapy cannot eliminate VPI, but it is recommended when needed as a first step to teach correct manner and place of articulation to resolve VPI compensatory misarticulations (e.g. glottal stop, glottal fricative, pharyngeal stop, pharyngeal fricative, lingua-velar stop, lingua-velar fricative, mid-palatal stop, posterior nasal fricative, and anterior nasal fricative). Surgical options include both palatal and pharyngeal procedures. Many craniofacial center surgeons are starting to base their surgical procedure recommendations on the individual's VPI defect (Dixon-Wood et al, 1991; Seagle et al, 2002).

Frequently performed surgeries are pharyngeal flap, Furlow palatoplasty, and sphincter pharyngoplasty. Pharyngeal flap has been associated with development of obstructive sleep apnea and hyponasal resonance. Furlow palatoplasty dissects the velar musculature and repositions it to a more favorable transverse orientation to optimize elevation (Conley et al, 1997). Sphincter pharyngoplasty is performed when the palate muscles are moving well, but inadequate VP closure is still present. The procedure moves muscle tissue from the lateral pharyngeal walls to the posterior nasopharynx (Figure 2). Surgery is not indicated for all patients with VPI; those with obstructive sleep symptoms or poor tissue quality are high risk for complications from VP surgery.

The pharyngeal obturator is a prosthetic device that can be used for short or long-term VPI management. It is similar to a dental retainer, but with a custom extension into the nasopharynx to fill the gap where the muscles do not touch. It can also be used to position the velum closer to its speech position in patients with neurologic or timing problems of VP function (Figure 3). The dental appliance is modified over a series of appointments to be placed in the air leakage gap site. The fabrication of the obturator and its use vary depending on the goals and needs of the patient. Some patients wear an obturator for a few years until growth permits surgery, while others continue indefinite use of the obturator. The use of an obturator for speech is analogous to wearing eyeglasses to compensate for visual defects.

The fabrication process and obturator use vary depending upon needs of the patient.
The basic steps in fabricating an obturator are making a maxillary dental appliance, modifying the appliance to desensitize the soft palate and extend into the velopharyngeal gap, and creating a “speech bulb” of a custom shape, position, and size to allow adequate muscle contact during speech (Figure 4). The appointments to create the bulb require collaboration between the dentist and SLP. The appliance is worn during the day and removed for sleep.

Speech improvement with prosthetic obturator use has led to enhanced quality of life for maxillectomy patients with well functioning prostheses (Kornblith et al, 1996). Only a few studies have evaluated the effectiveness of the obturator and its use for patients with VPI. There are anecdotal reports that the successful use of an obturator can lead to

improved VP muscle function with gradual bulb size reduction, and in some cases, elimination (Mark Anderson, personal communication). We were unable to identify any studies describing the clinical course and speech outcomes of patients managed with obturators.

PURPOSE

This case series describes the diagnosis, fabrication, and clinical course of patients with VPI managed in the obturator program at Seattle Children's Hospital (SCH). The data analysis allows a more complete understanding of its role in a multi-disciplinary approach for VPI treatment, including factors that influence outcome. This information can be used by other craniofacial centers considering the addition of a prosthetic program to their treatment options for VPI management. The results can give information to caregivers and patients as they make decisions among the VPI management options.

METHODS

The records of 28 patients receiving obturator management at Seattle Children's Hospital (SCH) from January 1, 2001 through November 30, 2012 were analyzed in this Institutional Review-approved study. SCH is a 245-bed tertiary-care pediatric teaching hospital located in Seattle, Washington (King Country), providing care from birth through age 21 years. All patients receiving treatment in the SCH obturator program were included in this study.

Patients at SCH with suspected VPI are evaluated by an SLP and an otolaryngologist in a stepwise standardized process. An SLP performs perceptual speech assessment to confirm the presence of VPI. Components of the perceptual assessment are rated including speech intelligibility, VPI severity, nasal air emissions and resonance. Speech intelligibility is categorized as normal or mildly, moderately, or severely impaired; VPI severity as none, mild, moderate, or severe; nasal air emissions as none, auscultatory, occasionally audible, or unobstructed; and resonance as hyponasal, normal, or mildly, moderately, or severely hypernasal. Indicated patients are referred for NP and speech videofluoroscopy (Sie et al, 2001).

The assessment begins with NP followed by speech videofluoroscopy. NP is performed by an otolaryngologist in conjunction with an SLP, who guides the speech protocol. The VP closure pattern is assessed (coronal, sagittal, transverse), and the size of the VP gap is estimated. Figure 5 illustrates NP results for two patients. Patient A has a circular

closure pattern and small VP gap. Patient B has a coronal closure pattern and large VP gap.

Frontal and lateral speech videofluoroscopy views are obtained. The frontal view is used to rate lateral pharyngeal medial motion from 0 bilaterally (no movement) to 0.5 bilaterally (contact at midline). Soft palate elevation and anterior motion of posterior pharynx are rated in the lateral view from 0 (no movement) to 1.0 (contact of palate and posterior pharynx). Other observations from the lateral view may be presence or absence of a Passavant ridge and level of best VP function (e.g. level of hard palate, above hard palate, or below hard palate). Palatal, lateral pharyngeal, and posterior pharyngeal wall motion are rated using the Golding-Kushner scale (Golding-Kushner et al, 1990). Figure 6 illustrates speech videofluoroscopy evaluations for two patients. Patient A has little soft palate function and suboptimal lateral wall function. Patient B has some soft palate function and little lateral wall function.

Patients referred for obturator fabrication are seen initially by an orthodontist. The appliance is made and modified to the stage of pharyngeal extension with a wire and small acrylic bulb. Subsequent appointments include an orthodontist and an SLP. Patients are seen at 3-6 month intervals after VP function is optimized. The appliance is modified or replaced as needed. The number of appointments varies depending upon patient factors including age, cooperation, and VP gap size.

All co-occurring diagnoses were recorded. Co-occurring diagnoses associated with speech, hearing, and ability to cooperate during appointments and comply with daily wear received additional analysis to explore association with obturator outcomes. Conditions thought to impact ability to tolerate an obturator included autism spectrum disorder, attention deficit hyperactivity disorder, and intellectual disability.

Data for this study came from the following sources: electronic medical record (Computerized Information System (CIS)), paper medical record (hard chart), and microfiche medical records. All variables recorded for this study are listed in Appendix 1. Data extraction and entry were performed by a single dentist examiner. This study was conducted under committee guidance as partial requirement for the Master's of Science in Dentistry Degree at the University of Washington.

Data was entered into a database program (Microsoft Excel®). Analysis was conducted with STATA Version 11.1 (StataCorp LP, College Station, TX). Descriptive statistics were calculated, including the mean and standard deviation for quantitative measures and frequency and percentage for categorical variables.

RESULTS

Twenty-eight patients (13 males and 15 females) were managed in the obturator program over the study period. Selected patient characteristics are displayed in Table 1. Mean patient age at the start of obturator fabrication was 8.2 ± 4.3 years (males: 6.6 ± 2.7 years; females: 9.6 ± 5.0 years). Most patients in the obturator program had severe VPI (57.1%, N=16), while the remaining were moderate (14.3%, N=4) and mild (14.3%, N=4), with four patients uncategorized.

Co-occurring diagnoses

Conditions co-occurring with VPI included craniofacial diagnoses (62%) with the most prevalent being cleft palate (24%) and cleft lip and palate (14%). Non-craniofacial comorbidities were obstructive sleep apnea (26%), dysarthria (19%), gastroesophageal reflux (14%), attention deficit hyperactivity disorder (10%), and autism spectrum disorder (7%). A comprehensive list of co-occurring diagnoses is included in Table 1. Co-occurring diagnoses associated with speech, hearing, or patient cooperation are listed in Table 2.

Medications

Medications were taken by 72.4% of the patients with the most to the least common medication categories including supplements (27.6%), airway support (20.7%), attention deficit hyperactivity disorder (17.2%), gastroesophageal reflux disease (10.3%), and antidepressants (10.3%).

Other Intervention

The majority of patients had received other speech treatments including speech therapy (86%), Furlow palatoplasty (38%), and sphincter pharyngoplasty (24%). Most patients started speech therapy between 1-3 years of age (67%).

Obturator fabrication

The number of appointments for patients in the obturator program totaled 492 with a mean of 16.4 ± 10.2. Patient appointments with the SLP totaled 246 with a mean of 8.4 ± 7.0. The mean number of appointments from delivery through pharyngeal extension with the bulb was 3.8 ± 1.9. The mean number of bulb-modifying appointments needed to provide adequate VP closure assistance was 4.9 ± 3.7.

There were a total of 23 appliance remakes for a variety of reasons including growth (N=10, 43.5%), broken appliances or clasps (N=4, 17.4%), lost appliances (N=4, 17.4%), orthodontics (N=3, 13.0%), and shifted teeth/ post-alveolar bone graft (N=2, 8.7%) (Figure 7). Only 3 of 492 (0.6%) appointments were emergent with two from pain and one from traumatic ulcer.

Most patients in this study are still active (67.8%); among active patients 75% are growing, and 25% have finished growing. Nine patients who are no longer active discontinued treatment due to: family decision (N=3), family move (N=2), VPI surgery (N=2), alternate therapy (N=1) or uncooperative behavior (N=1).

Speech Outcomes

Obturators resulted in improved speech for nearly all patients (92.9%, N=26) with complete resolution with obturator in place for 50.0% (N=14). The best results were achieved in patients with an anatomical defect without intellectual disability. Patients with less successful outcomes were those with dysarthria, facial nerve weakness, intellectual disability, and mitochondrial cytopathy. Twelve patients had conditions impacting behavior and cooperation; of these, 3 discontinued treatment, even though speech was improved.

DISCUSSION

Prosthetic obturation is a management option for patients who do not qualify for speech surgery because of contraindications such as obstructive sleep apnea and other sleep problems, or when families favor non-surgical intervention. Our research found that wearing an obturator did not stimulate VP muscle function to eliminate or decrease VPI. VPI obturator management should be viewed as an ongoing treatment modality. The majority of patients with obturators were still in active status, even after craniofacial growth was complete.

Obturators were an interim measure until growth, orthodontia, or both were finalized for some of our patients. Obturators have served as a long-term option for patients to optimize timing of speech surgeries, as well as for those who will not become surgical candidates. With increased awareness of the adverse effects of sleep disordered breathing, including poor learning, behavioral problems, and attention symptoms, obturator use can provide an alternative treatment modality (Marcus et al, 2012).

This case series illustrates the diverse patient populations that can benefit from obturator management of VPI. Nearly all patients benefited from obturator use. Benefits include enhanced quality of life with improved intelligibility at school and in social settings. With adequate VP closure facial grimacing resolves and VPI compensatory misarticulations can be more readily treated with speech therapy. Obturators can be modified as a patient grows and are reversible while surgical co-morbidities such as obstructive sleep apnea are avoided.

Disadvantages for VPI obturator management are the multiple appointments required, travel concerns for some patients, potential to lose or damage an appliance, and inability to perform orthodontic palate expansion with the obturator in place. Our results illustrate the difficulties some patients have with compliance, most frequently a problem for those with intellectual disabilities or behavioral challenges.

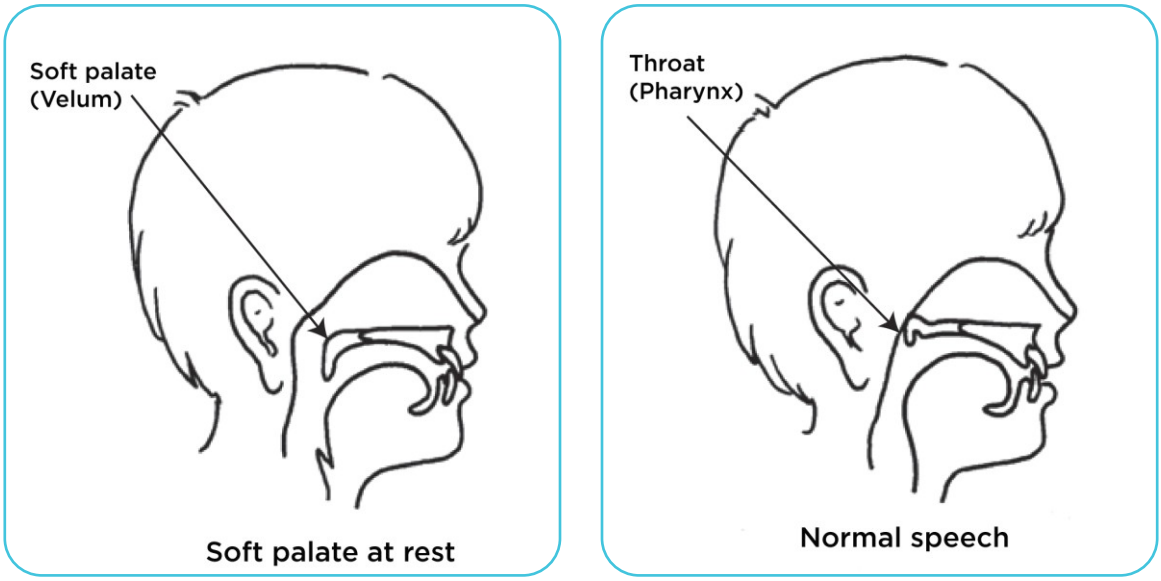
Other factors when considering obturator management are the close collaboration necessary between the dentist, SLP, and the community SLP. The obturator team SLP does not provide speech therapy for the patients, necessitating frequent communication between the SLPs. The current obturator team is an orthodontist and an SLP; however, previous teams were a pediatric dentist and an SLP.

Limitations of this study are the variations in record keeping among multiple providers and the subjective nature of speech assessment. The small patient numbers may obscure effects of co-occurring conditions. For example, patients with dysarthria may not benefit from obturator management.

Our results demonstrate that prosthetic obturators are versatile and effective for a variety of patients with VPI. The details provided about the typical clinical course can help clinicians and patients decide if an obturator should be among the management options considered for a patient with a new VPI diagnosis.

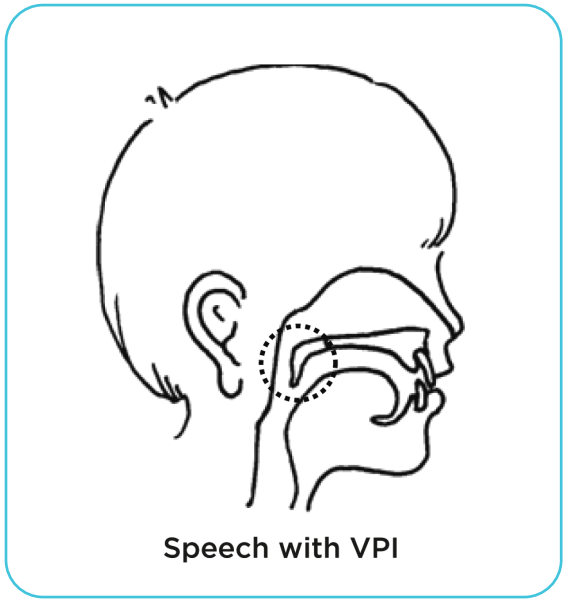
FIGURES

Figure 1a. Soft palate at rest and during normal speech with adequate speech closure



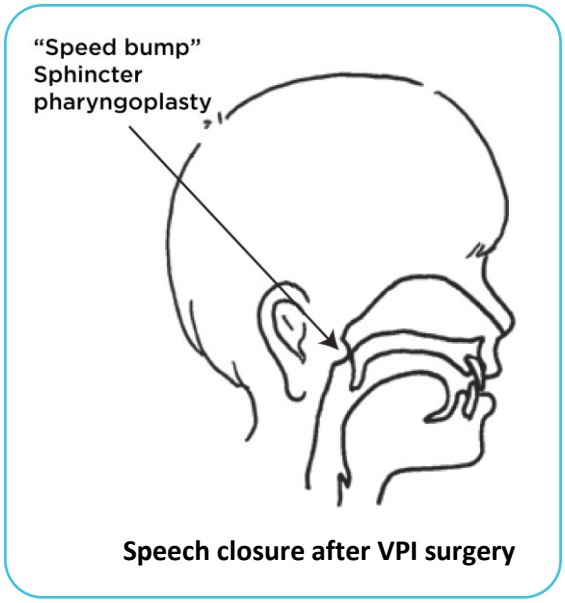
Seattle Children's Hospital et al.; "Soft palate at rest"; Velopharyngeal Insufficiency: Overview; seattlechildrens.org, Web; 6 Jun. 2013 | Seattle Children's Hospital et al.; "Normal speech"; Velopharyngeal Insufficiency: Overview; seattlechildrens.org, Web; 6 Jun. 2013

Figure 1b. Velopharyngeal insufficiency with inadequate speech closure



Seattle Children's Hospital et al.; "Speech with VP"; Velopharyngeal Insufficiency: Overview; seattlechildrens.org, Web; 6 Jun. 2013

Figure 2. Sphincter pharyngoplasty



Seattle Children's Hospital et al.; "Speech with VPI after surgery"; Velopharyngeal Insufficiency: Treatments; seattlechildrens.org, Web; 6 Jun. 2013

Figure 3. Pharyngeal obturator

Seattle Children's Hospital et al.; "Obturator"; Velopharyngeal Insufficiency: Treatments; seattlechildrens.org, Web; 6 Jun. 2013

Figure 4. Four stages of obturator fabrication: a) Palatal plate; b) Tail extension; c) Mini pharyngeal bulb; d) Custom modified pharyngeal bulb

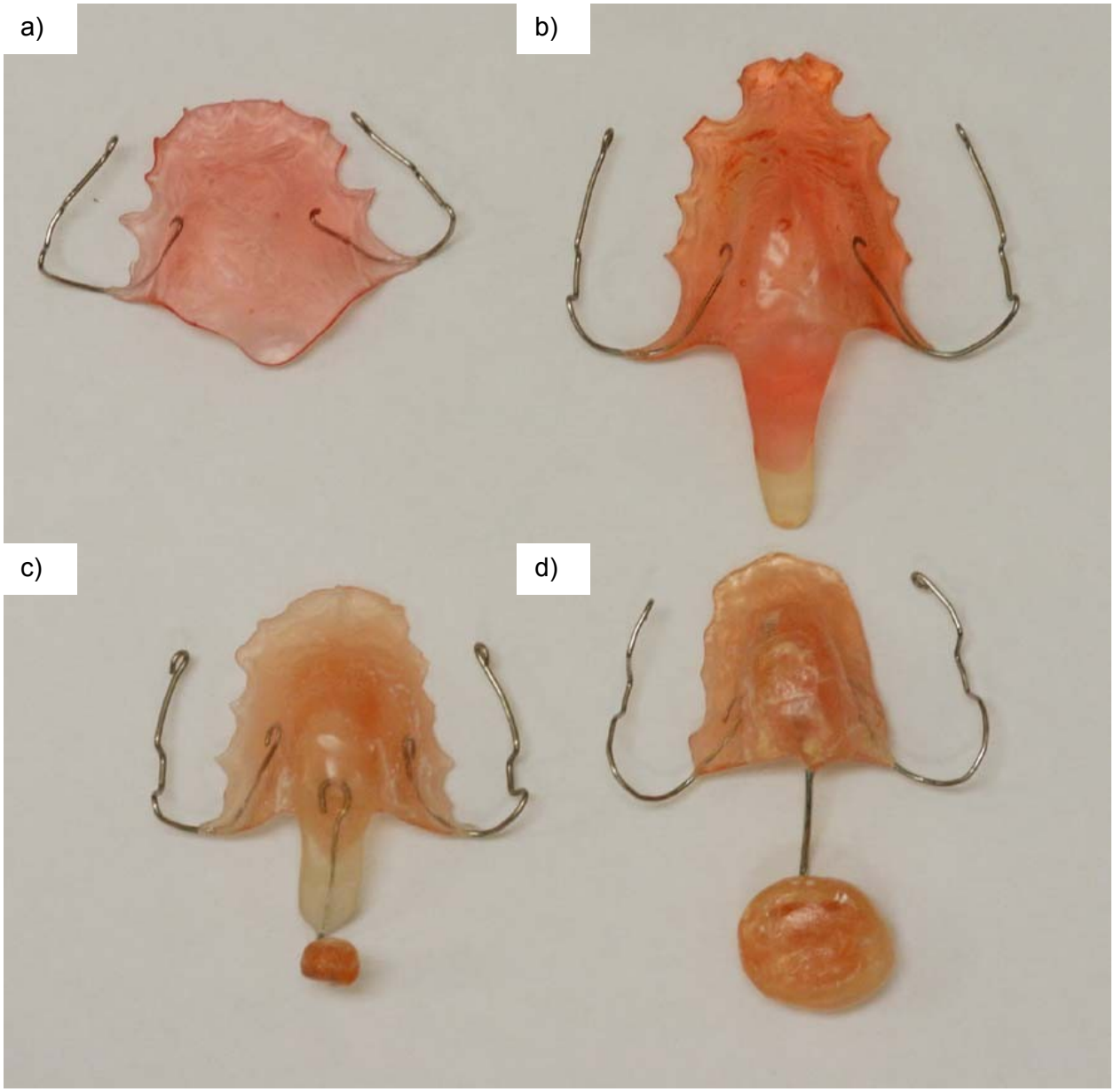
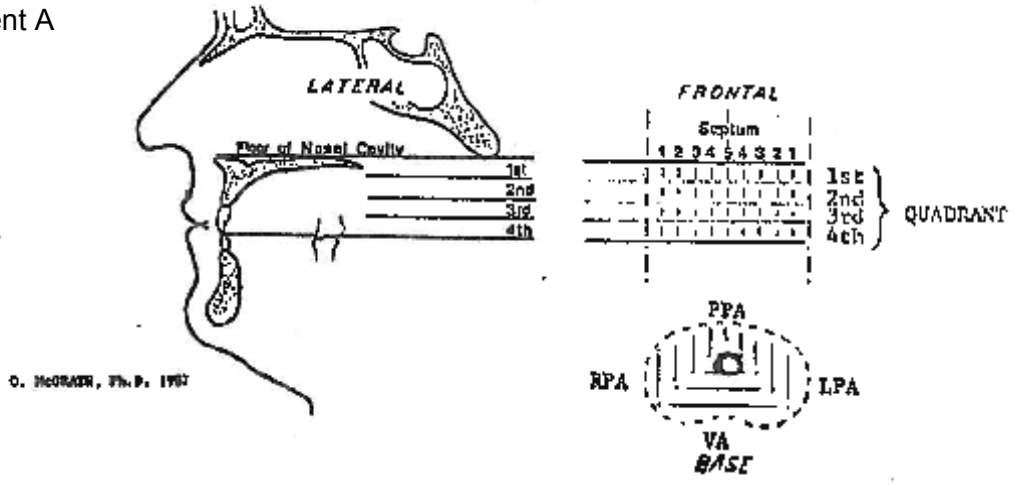


Figure 5. Nasopharyngoscopy examination results

Patient A



Patient B

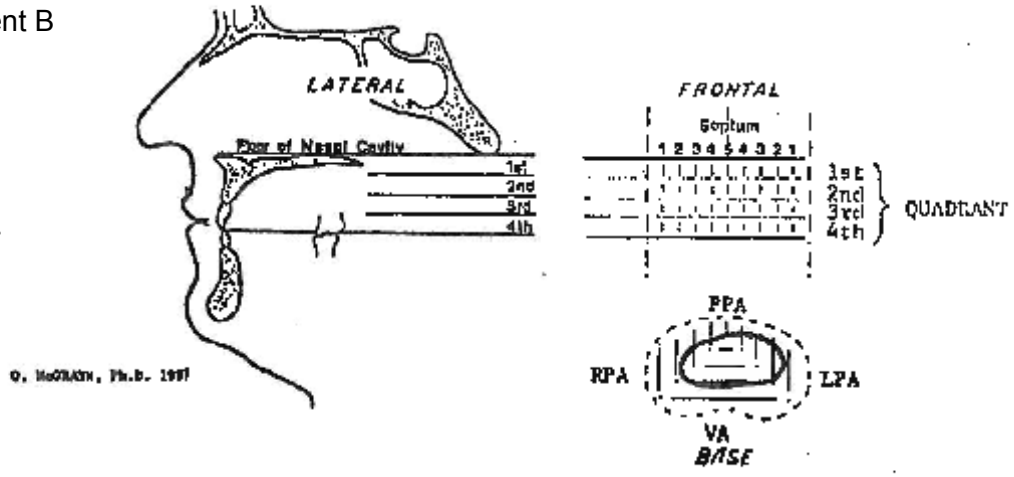
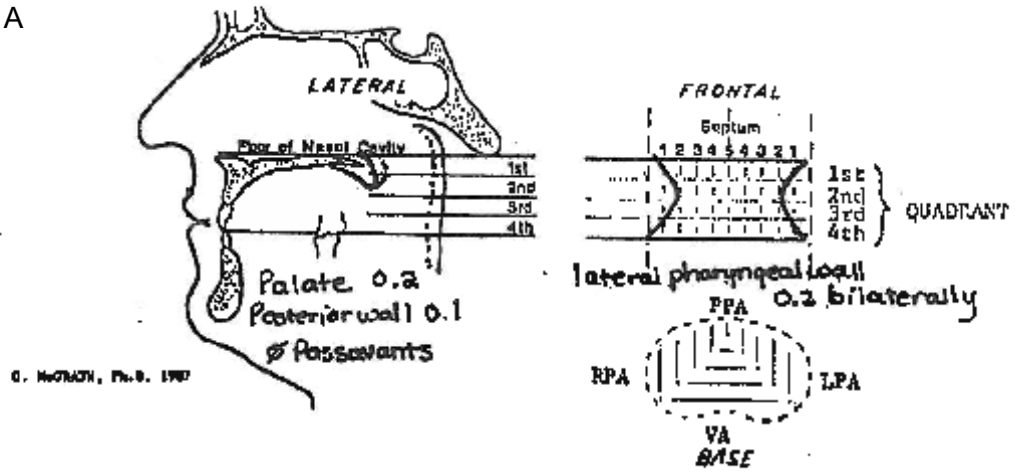


Figure 6. Speech videofluoroscopy examination results

Patient A



Patient B

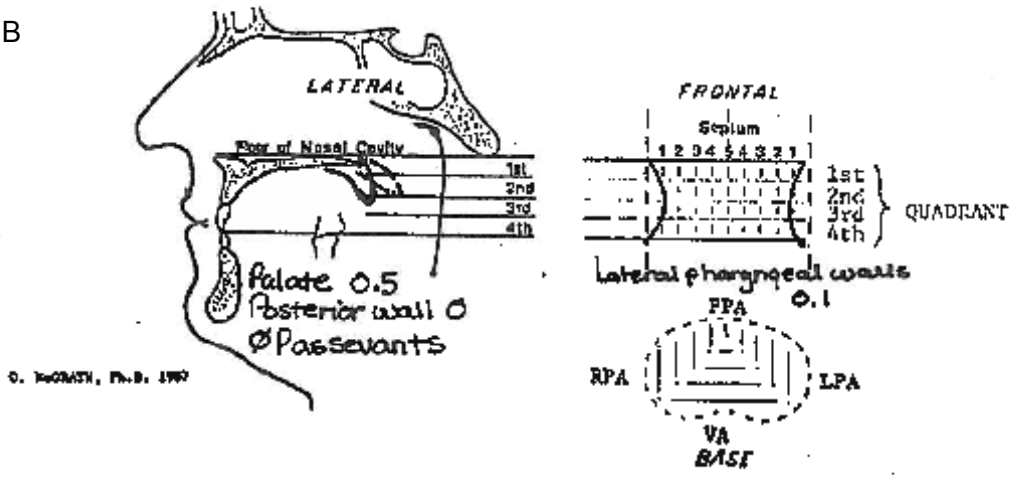
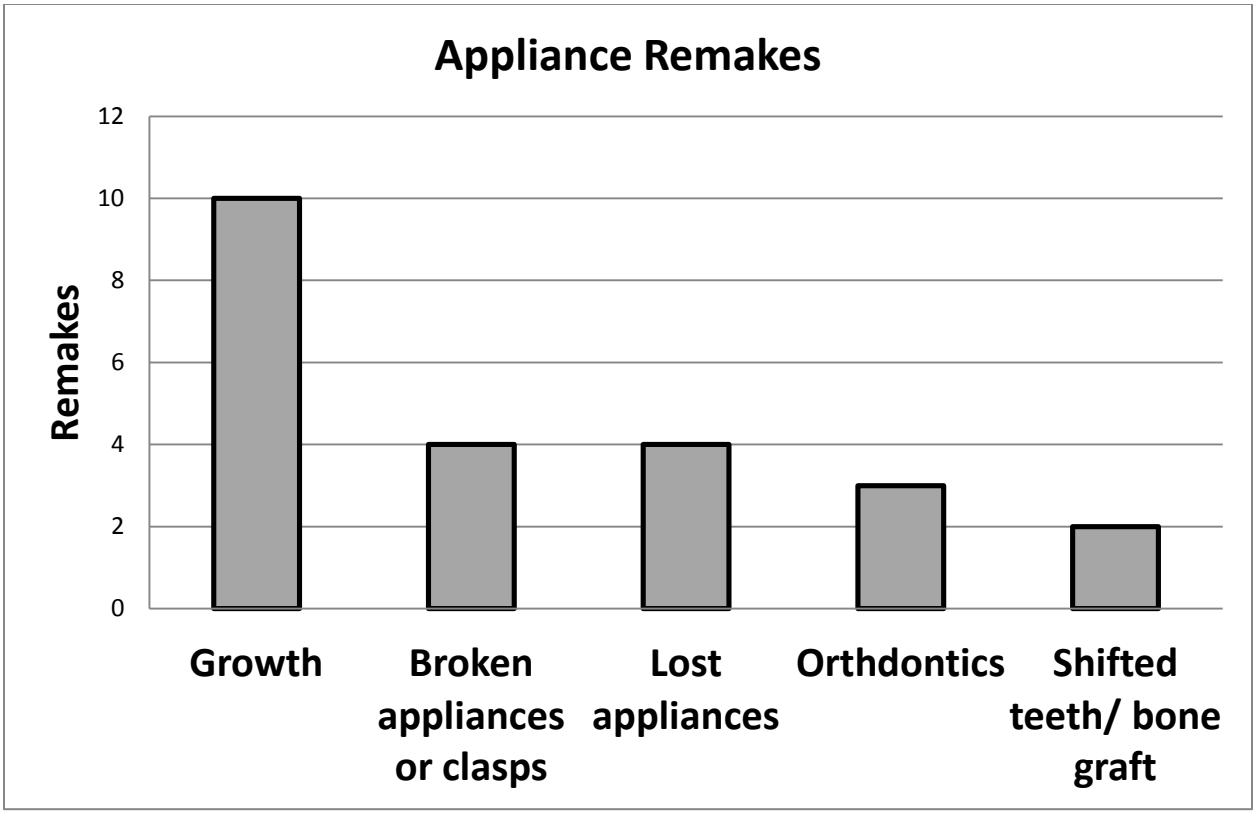


Figure 7. Obturator appliance remakes



TABLES

Table 1. Co-occurring diagnoses with VPI

Table 1. Co-occurring diagnoses with VPI								
Pt ID	Diagnosis 1	Diagnosis 2	Diagnosis 3	Diagnosis 4	Diagnosis 5	Diagnosis 6	Diagnosis 7	Diagnosis 8
1	Noonan syndrome	Duodenal hematoma	Roux-en-Y duodenojejunostomy	Irritable bowel syndrome	Constipation			
2	Bilateral cleft lip/ palate	Ventricular septal defect	Class III malocclusion with missing teeth	Hearing loss (right conductive)				
3	Cleft palate	Obstructive Sleep Apnea	Asperger syndrome	Tourette syndrome	Attention deficit hyperactivity disorder	Gastroesophageal Reflux	Anxiety Disorder	Obsessive-compulsive disorder
4	Trisomy 21	Bilateral conductive hearing loss	Dyspraxia	Hypothyroid	Cardiac malformation			
5	Cleft palate	Mandibular hypoplasia	Stickler's syndrome	Pierre Robin malformation	Gastroesophageal Reflux	Obstructive Sleep Apnea	Anorexia Nervosa	Anxiety Disorder
6	Traumatic brain injury (01/2006)	Spasticity	Gastrostomy tube	Aphasia	Dysarthria			
7	Chromosome 22q11.2 deletion	Chronic rhinosinusitis	Bilateral otorrhea	Eustachian tube dysfunction	Attention Deficit Hyperactivity Disorder	Growth hormone deficiency		
8	Chromosome 22q11.2 deletion	Ventricular septal defect	Cleft palate	Developmental delay	Hearing loss	Verbal dyspraxia	Eustachian tube dysfunction	
9	Unilateral cleft lip and palate (right)	Vesicoureteral reflux	Eustachian tube deficiency					

Pt ID	Diagnosis 1	Diagnosis 2	Diagnosis 3	Diagnosis 4	Diagnosis 5	Diagnosis 6	Diagnosis 7	Diagnosis 8
10	Simpson-Golabi-Behmel syndrome	Cleft palate	Urologic malformation	Attention deficit hyperactivity disorder	Obstructive sleep apnea			
11	Unilateral cleft lip and palate (right)							
12	Ehlers-Danlos syndrome	intellectual disability	obstructive sleep apnea					
13	Cleft palate	eustachian tube dysfunction						
14	Cleft palate	Obstructive Sleep Apnea		Partial onset epilepsy				
15	mitochondrial cytopathy	glutaconic aciduria type 2	hypotonia	dysphagia	Gastroesophageal Reflux	gastostomy tube	positional plagiocephay with torticollis	
16	Developmental delay	Dysarthria						
17	Pierre Robin malformation	cleft palate	gastrostomy tube					
18	Eustachian tube deficiency	Tonsillar hypertrophy	Cholesteatoma (left middle ear)	Dysarthria				
19	chromosome 22q11.2 deletion	Submucous cleft palate	dysphagia	gastrostomy tube	Gastroesophageal Reflux			
20	bilateral craniofacial microsomia	bilateral microtia and atresia	right facial nerve palsy	obstructive sleep apnea	bilateral conductive hearing loss	fetal alcohol syndrome		

Pt ID	Diagnosis 1	Diagnosis 2	Diagnosis 3	Diagnosis 4	Diagnosis 5	Diagnosis 6	Diagnosis 7	Diagnosis 8
21	Russell-Silver syndrome	Submucous cleft palate	Premature birth 35 weeks' gestation	Developmental delay	Difficult airway with complication history during intubation	Limited mouth opening	Low weight and growth deficiency	Eustachian tube deficiency
22	Ventricular septal defect	Submucous cleft palate	Right ventricular outflow tract muscle bundle with mild obstruction	Kawasaki disease				
23	Autism spectrum disorder	Developmental delay	rheumatoid arthritis	migraine headaches				
24	neurosarcoidosis	seizures	speech delays	dysarthria	sialorrhea	malocclusion		
25	Attention deficit hyperactivity disorder	Bilateral sensorineural hearing loss						
26	Bilateral cleft lip/ palate	Oronasal fistula	Reactive airway disease					
27	Choanal atresia status post surgical correction	Nasal obstruction	Partial trisomy 20	Obstructive Sleep Apnea				
28	Right facial nerve weakness	Sensorineural hearing loss	Type I Diabetes					

Table 2. Co-occurring speech, hearing, or behavioral diagnoses

Table 2. Co-occurring speech, hearing, or behavioral diagnoses					
Pt ID	**Diagnosis 1**	**Diagnosis 2**	**Diagnosis 3**	**Diagnosis 4**	**Diagnosis 5**
1	Noonan syndrome				
2	Bilateral cleft lip/ palate				
3	Cleft palate	Obstructive Sleep Apnea	Asperger syndrome		
4	Trisomy 21	Dyspraxia			
5	Cleft palate	Stickler's syndrome	Obstructive Sleep Apnea	Anxiety Disorder	
6	Traumatic brain injury	Aphasia	Dysarthria		
7	chromosome 22q11.2 deletion	Attention Deficit Hyperactivity Disorder			
8	chromosome 22q11.2 deletion	cleft palate	Intellectual disability	verbal dyspraxia	
9	Unilateral cleft lip and palate (right)				
10	Simpson-Golabi-Behmel syndrome	cleft palate	Attention deficit hyperactivity disorder	Obstructive Sleep Apnea	
11	Unilateral cleft lip and palate (right)				
12	Ehlers-Danlos syndrome	Intellectual disability	obstructive sleep apnea		
13	Cleft palate				
14	Cleft palate	Obstructive Sleep Apnea			
15	mitochondrial cytopathy	hypotonia	dysphagia		
16	Intellectual disability	Dysarthria	Autism spectrum disorder		
17	Pierre Robin malformation	cleft palate			
18	Dysarthria				
19	chromosome 22q11.2 deletion	Submucous cleft palate	dysphagia		
20	bilateral craniofacial microsomia	right facial nerve palsy	obstructive sleep apnea	bilateral conductive hearing loss	fetal alcohol syndrome
21	Russell-Silver syndrome	Submucous cleft palate			

Pt ID	Diagnosis 1	Diagnosis 2	Diagnosis 3	Diagnosis 4	Diagnosis 5
22	Submucous cleft palate				
23	Autism spectrum disorder	Intellectual disability	rheumatoid arthritis		
24	Neurosarcoidosis	dysarthria			
25	Attention deficit hyperactivity disorder	Bilateral sensorineural hearing loss			
26	Bilateral cleft lip/ palate				
27	Partial trisomy 20	Obstructive Sleep Apnea			
28	Right facial nerve weakness				

Table 3. Obturator patient demographics

Demographics of patients in the obturator program				
		All Patients N=28	Males N=13	Females N=15
Age at start of obturator (years)	Mean ± (SD)	8.2 ± (4.3)	6.6 ± (2.7)	9.6 ± (5.0)
	Median, Range	6.8, 3.1 – 20.1	5.4, 4.2 – 12.1	7.8, 3.1 – 20.1

		N (%)
Gender	Male	13(46%)
	Female	15(54%)

		N (%)
VPI Severity	Severe	16 (57.1%)
	Moderate	4 (14.3%)
	Mild	4 (14.3%)
	Uncategorized	4 (14.3%)

Table 4. Conditions co-occurring with VPI

Conditions Co-occurring with VPI		
	Total N	%
CRANIOFACIAL DIAGNOSES:	**18**	**62.1 %**
Bilateral craniofacial microsomia	1	3.4 %
Cleft lip and palate	4	13.8 %
Cleft palate	7	24.1 %
Noonan syndrome	1	3.4 %
Partial trisomy 20	1	3.4 %
Pierre Robin malformation	2	6.9 %
Russell-Silver syndrome	1	3.4 %
Simpson-Golabi-Behmel syndrome	1	3.4 %
Stickler syndrome	1	3.4 %
Submucous cleft palate	3	11.1 %
Velocardiofacial syndrome	3	11.1 %
Dysarthria	5	18.5 %
Obstructive sleep apnea	7	25.9 %

BIBLIOGRAPHY

1. Conley, SF, AK Gosain, SM Marks, and DL Larson. "Identification and Assessment of Velopharyngeal Inadequacy." American Journal of Otolaryngology. 18.1 (1997). Print.
2. Dixon–Wood VL, Williams WN, Seagle MB. “Team acceptance of specific recommendations for the treatment of VPI as provided by speech pathologists.” Cleft Palate Craniofac J 1991, 28:285–290. Discussion. Cleft Palate Craniofac J 1991, 28:285–290.
3. Dotevall H, Lohmander–Agerskov A, Ejnell H, et al.: “Perceptual evaluation of speech and velopharyngeal function in children with and without cleft palate and the relationship to nasal airflow patterns.” Cleft Palate Craniofac J 2002, 4:409–424.
4. Golding-Kushner K, Argamaso R, Cotton R, et al.: Standardization for the reporting of nasopharyngoscopy and multiview videofluoroscopy: A report form an International Working Group. Cleft Palate J. 1990, 27:337.
5. Hardin MA, Van Demark DR, Morris HL, et al.: “Correspondence between nasalance scores and listener judgments of hypernasality and hyponasality.” Cleft Palate Craniofac J 1992, 29:346–351.
6. Kornblith, AB, IM Zlotolow, J Gooen, JM Huryn, T Lerner, EW Strong, JP Shah, RH Spiro, and JC Holland. "Quality of Life of Maxillectomy Patients Using an Obturator Prosthesis." Head & Neck. 18.4 1996). Print.
7. Kummer, Ann W. Cleft Palate and Craniofacial Anomalies: Effects on Speech and Resonance. Clifton Park, N.Y: Thomson Delmar Learning, 2008. Print.
8. Persson C, Elander A, Lohmander–Agerskov A, et al.: “Speech outcomes in isolated cleft palate: impact of cleft extent and additional malformations.” Cleft Palate Craniofac J 2002, 4:397–408.
9. Seagle MB, Mazaheri MK, Dixon–Wood VL, et al.: “Evaluation and treatment of velopharyngeal insufficiency: the University of Florida experience.” Ann Plast Surg 2002, 5:464–470.
10. Seattle Children’s Hospital. "Velopharyngeal Insufficiency Overview" Chromosomal and Genetic Conditions, Seattle Children’s Hospital, 7 December, 2011. <http://www.seattlechildrens.org/medical-conditions/chromosomal-genetic-conditions/vpi/>.
11. Section on Pediatric Pulmonology, Subcommittee on Obstructive Sleep Apnea Syndrome. American Academy of Pediatrics. (January 01, 2002). Clinical practice guideline: diagnosis and management of childhood obstructive sleep apnea syndrome. Pediatrics, 109, 4, 704-12.
12. Sie, Kathleen C. Y. M.D.; Tampakopoulou, Dimitra A. M.D.; Sorom, Jeb B.A.; Gruss, Joseph S. M.D.; Eblen, Linda E. M.A., C.C.C.-S. “Results with Furlow Palatoplasty in Management of Velopharyngeal Insufficiency.” Plastic & Reconstructive Surgery. 2001, 1:17-25
13. Webster, R. C., Cleft palate. Oral Surg. oral med. Oral path., 1, 647-669 (1948)
14. Willging, JP. "Velopharyngeal Insufficiency." Current Opinion in Otolaryngology & Head and Neck Surgery. 11.6 (2003): 452-5. Print.
15. Witzel, MA, Rich RH, Margar-Bacal F, et al: “Velophayrngeal insufficiency after adenoidectomy: An 8-year review.” Int J Pediatr Otorhinolaryngol 11:15-20, 1986

APPENDIX

Appendix A: Patient Medication Data

PtID	Gender	medication1	medication2	medication3	medication4	medication5	medication6	medication7	medication8	medication9	medication10	medication11
1	F	Airway - triamcinolone (Nasacort)	Airway - loratadine (Alavert)									
2	F	Airway - albuterol	Abx - doxycycline	BCP - ethinyl estradiol-norethindrone (Microgestin)	Airway - fluticasone (Flovent)	Airway - fluticasone (Flonase)	Airway - montelukast (Singulair)	GERD - omeprazole (Prilosec)	ADHD - methylphenidate (Concerta)	Antidepressant - buspirone (BuSpar)	Muscle relaxant? - cyclobenzaprine (Flexeril)	Antidepressant - duloxetine (Cymbalta)
3	F	Abx - amoxicillin										
4	M	ADHD - Dextroamphetamine/Amphetamine (Adderall)										
5	M	Insulin - insulin lispro (Humalog)										
6	M	none										
7	F	Baclofen	Antidepressant - escitalopram (Lexapro)									

PtID	Gender	medication1	medication2	medication3	medication4	medication5	medication6	medication7	medication8	medication9	medication10	medication11
8	F	Thyroid - levothyroxine (Synthroid)	Supplement - multivitamin	Supplement - Calcium tablets								
9	M	none										
10	M	ADHD - methylphenidate										
11	M	none										
12	M	GH - Growth hormone	Airway - albuterol prn									
13	F	BCP - medroxyprogesterone (Depo Provera)										
14	F	none										
15	M	Abx - amoxicillin/clavulanic acid (Augmentin)	Abx (topical) - mupirocin (Bactroban nasal)	GH - somatropin (Nutropin)	ADHD - dextroamphetamine/Amphetamine (Adderall)							
16	M	Supplement - multivitamin										
17	M	Airway - albuterol prn	Supplement - multivitamin		Airway - fluticasone (Flonase) discontinued as of 3/9/2011	Airway - Mometasone furoate (Nasonex) discontinued as of 3/9/2011						

PtID	Gender	medication1	medication2	medication3	medication4	medication5	medication6	medication7	medication8	medication9	medication10	medication11
18	M	Gout - allopurinol	GERD - esomeprazole (Nexium)	Metabolic - leucovorin	Metabolic - coenzyme q10	Airway - cetirizine (Zyrtec)	Supplement - multivitamin	Supplement - iron + herbs	Supplement - superfood vitamin	Supplement - riboflavin		
19	M	Airway - montelukast (Singulair)	Airway - cetirizine (Zyrtec)	Airway - fluticasone (Flonase)	Airway - albuterol prn							
20	F	Supplement - fluoride tablets										
21	F	none										
22	F	Hypertension - atenolol	Seizure - topiramate	Supplement - fish oil	Supplement - multivitamin	NSAID - ibuprofen prn (for migraines)	GERD - lansoprazole	Airway - cyproheptadine	Metabolic - methotrexate			
23	F	Supplement - multivitamin	Supplement - omega-3	Supplement - probiotics								
24	M	ADHD - methylphenidate (Concerta)	Supplement - multivitamin									
25	F	none										
26	F	none										
27	F	Seizure - trileptal	Seizure - diastat prn (never used)	Supplement - multivitamin	Supplement - omega-3							
28	F	Antidepressant - fluoxetine	Arthritis - meloxicam									

Appendix B: Parent Speech Assessment Data

Pt ID	Parent speech date	Speech intelligibility	Nighttime breathing	Chronic nasal congestion	diet	Chew swallow	Gag choke drool	suck	blow	Nasal regurgitation
1	3/26/2003	usually understood to unfamiliar listeners	snore	n/a	regular	*normal	n/a	n/a	n/a	n/a
2		usually unintelliglbe to unfamiliar listeners			regular	*normal				
3	12/10/2003	understood by mother, unintelligible to unfamiliar listeners	n/a	n/a	regular	*normal	n/a	n/a	n/a	n/a
4	3/18/2008	Usually understood by mother, more difficult over the phone; unfamiliar listeners do not understand her	n	n	regular	normal	n	y	y	n
5	2/9/2005	Mild (usually understood by mother, mildy difficult to understand to unfamiliar listeners)	obstructive sleep apnea	n	regular	normal	n	y	y	occasionally
6	9/10/2008	often understood by grandmother, frequent repetition and more difficult for unfamiliar listeners	n	n	modified for dysphagia	swallow with verbal cues	drool	n/a	n/a	n/a
7	11/13/2002	n/a	n	n/a	regular	*normal	n/a	n/a	n/a	n/a
8	3/5/2012	usually understood by parents, have to decipher for unfamiliar listeners	n	n	regular	normal	n	y (1/14/2008)	y (1/14/2008)	n
9	5/15/2007	understood 50% of the time by family on his first attempt, occasional repetition for unfamiliar listeners	n	y	regular	normal	n/a	y	y	n

Pt ID	Parent speech date	Speech intelligibility	Nighttime breathing	Chronic nasal congestion	diet	Chew swallow	Gag choke drool	suck	blow	Nasal regurgitation
10	10/26/2009	understood with context by mother and unfamiliar listeners	snore	n	regular	normal	n	n/a	n/a	n
11	n/a	usually understood to unfamiliar listeners			regular	*normal				
12	8/26/2010	understood most of her speech by mother, occasional repetition for unfamiliary listeners	snore	n	regular	normal	choking when drinking rapidly	n/a	n/a	frequently
13	3/9/2005	unintelligible to unfamiliar listeners	n	n	regular	normal	n	y	y	occasionally
14	6/2/2005	usually understood by parents, unintelligible to unfamiliar listeners	n	congestion	regular	normal	n	y	y	n
15	8/25/2011	understood most of the time by father, frequent repetition for unfamiliar listeners	n	n	primarly g-tube fed	n/a	gag/drool	n/a	n/a	n/a
16	4/28/2010	Speech is clearer when he imitates or uses short and well-rehearsed utterences.	n	n	prefers soft foods	could not chew a carrot, juts chin forward and makes a clunk sound when swallowing	Chokes if he's excited when he eats, Two botox injections to decrease drooling.	n	n	n
17	2/11/2010	understood most of the time by father, 60% for unfamiliar listeners	n	n	regular	normal	n	y (4/7/2009)	n (difficult - 4/7/2009)	very infrequently
18	3/22/2006	n/a	n	n/a	*regular	*normal	n/a	n/a	n/a	n

Pt ID	Parent speech date	Speech intelligibility	Nighttime breathing	Chronic nasal congestion	diet	Chew swallow	Gag choke drool	suck	blow	Nasal regurgitation
19	1/26/2012	understood 75% of the time by mother, frequent repetition for unfamiliar listeners	n	n	regular	normal	choke/ gag	n/a	n/a	occasionally
20	2/14/2011	understood 90% of the time by mother, 25% by unfamiliar listenters	no	n/a	regular	normal	n/a	n/a	n/a	occasionally
21	8/24/2011	understood 60% of the time by mother, 25% for unfamiliar listeners	n	n	prefers soft foods	normal	n (may gag on large bolus)	y	n (difficult)	n
22	8/24/2007	needs to ask him to repeat, usually unintelligible to other	n	n/a	regular	normal	n	n/a	n/a	n
23	8/11/2010	understood 70% of the time by mother, 50% for unfamiliar listeners	snore	y	regular	normal	when drinking, increased choking	n/a	n/a	frequently
24	5/14/2008	n/a	n	n	regular	cannot chew in rotary motion, uses fingers to move food in her mouth, coughs sometimes when swallows	drooling has decreased a lot and comes and goes	y	y	n
25	10/19/2010	Understood with context by parents, usually unintelligible to unfamiliar listeners	n	n	regular	normal	n	y	n	occasionally
26	9/19/2011	understood most of the time by mother, less than 50% for unfamiliar listeners	snore	n	regular	normal	n	y	y	n
27	3/10/2010	understands most of the time, 60-70% over phone, unfamiliar listeners 75-80%	snore	congestion	regular	normal	n	y	y	n
28	2/10/2011	Understood 70% time by mother, usually need multiple repetitions with other people	n	n	regular	normal	n	y (difficult)	n (must plug nose)	occasionally

Appendix C: Perceptual Speech Assessment

Pt ID	Perceptual speech date	Articulation 1	Articulation 2	Articulation 3	Articulation 4	Voice quality	Nasal air emissions	Nasal for non-nasal	resonance	Speech volume	Facial grimace	VPI severity
1	3/26/2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	facial	severe
2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	12/10/2003	n/a	n/a			n/a	audible	n/a	n/a	n/a	n/a	severe
4	3/18/2008	n/a	n/a			mildly breathy speaking softly, normal otherwise	auscultatory	n/a	balanced to severe	impaired	none	severe
5	4/11/2005	n/a	n/a			weak	auscultatory	n	moderate	low	none	mild
6	9/10/2008	n/a	n/a			vocal fry	n/a	n/a	moderate	n/a	n/a	severe
7	11/13/2002	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	severe
8	3/5/2012	glottal stop	glottal fricative			normal	unobstructed	y	severe	normal	n	severe
9	5/15/2007	glottal stop	n/a			hoarse	audible	n/a	mild	impaired	nasal	moderate
10	10/26/2009	glottal stop	glottal fricative	lingua-velar stop and fricative	anterior nasal fricative	normal	audible	n	severe	low	n	severe
11	4/8/2004	glottal stop						y				moderate
12	8/26/2010	n/a	n/a	n/a	n/a	reduced pitch with monotone stress	unobstructed	n/a	mild	n/a	n	moderate
13	3/9/2005	n/a	n/a			n/a	audible	n/a	n/a	n/a	n/a	n/a

Ptl D	Perceptual speech date	Articulation 1	Articulation 2	Articulation 3	Articulation 4	Voice quality	Nasal air emissions	Nasal for non-nasal	resonance	Speech volume	Facial grimace	VPI severity
14	6/2/2005	glottal stop	n/a			normal	occasionally audible	y	severe	low	facial	severe
15	8/25/2011	glottal stop	dental bilabial fricative			characterized by wet vocal quality	audible	y	moderate	n/a	n	severe
16	4/28/2010	glottal stop	substitute 't' for some later-emerging fricative sounds such as 's', 'z', and 'th'			normal	unobstructed	y	severe	low	n	n/a
17	2/11/2010	glottal stop	n/a			hoarse	occasionally audible	y	balanced	minimally impaired	n	mild
18	3/22/2006	n/a	n/a			n/a	unobstructed	y	n/a	n/a	facial	severe
19	8/1/2011	glottal stop	n/a			normal	audible	y	moderate	n/a	nasal	moderate
20	2/14/2011					normal	audible	y	cul-de-sac	n/a	facial	severe
21	8/24/2011	glottal stop	glottal fricative			normal	unobstructed	y	severe	minimally impaired	n	severe
22	8/24/2007	glottal stop	n/a			normal	unobstructed	y	severe	impaired	nasal	severe
23	8/11/2010	n/a	n/a			normal	occasionally audible	n	mild	n/a	nasal	mild
24	5/14/2008	glottal stop	glottal fricative	anterior nasal fricative		normal	n/a	y	n/a	n/a	facial	n/a

Pt ID	Perceptual speech date	Articulation 1	Articulation 2	Articulation 3	Articulation 4	Voice quality	Nasal air emissions	Nasal for non-nasal	resonance	Speech volume	Facial grimace	VPI severity
25	10/19/2010	glottal stop	n/a			hoarse	auscultatory	y	severe	impaired	none	severe
26	9/19/2011	glottal stop	n/a			n/a	audibule	y	severe	impaired	facial	severe
27	3/10/2010	n/a	n/a			normal	occasionally audible	n	cul-de-sac	normal	nasal	mild
28	2/10/2011	glottal stop	glottal fricative			hoarse	auscultatory	y	severe	impaired	facial	severe

Appendix D: Instrumental Speech Data

Pt ID	NP date	NP right lateral wall	NP left lateral wall	Closure pattern	NP palate elevation	NP anterior palate motion	NP Pssavant ridge	NP levator orientation	Speech VF date	VF palate movement	VF posterior pharyngeal movement	VF right lateral wall	VF left lateral wall
1	3/26/2003	0.1	0.1	n/a	0.7	0	n/a	n/a	3/26/2003	0.5	0	0.3	0.3
2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	12/10/2003	0.3	0.3	coronal	0.9	0	y	n/a	12/10/2003	0.6	0.1	0.3	0.3
4	11/8/2006	0.3	0.3	n/a	0.95	0	n/a	n/a	6/25/2008	0.9	0	0.4	0.4
5	2/9/2005	0.2	0.2	coronal	1	0	n	n/a	2/9/2005	0.7	0.2	0.2	0.2
6	9/10/2008	0.1	0.1	n/a	0.6	0	n	n/a	9/10/2008	0	0	0.1	0.1
7	11/13/2002	0.3	0.3	n/a	0.8	0	y	n/a	n/a	n/a	n/a	n/a	n/a
8	4/25/2012	0.3	0.4	sagittal	0	0	n	n/a	4/25/2012	0.8	0.1	0.4	0.4
9	7/25/2007	0.2	0.2	coronal	0.5	0	n	transverse	7/25/2007	0.5	0	0.2	0.2
10	3/25/2010	0.3	0.3	round	0.87	0	n/a	transverse	3/25/2010	0.5	0	0.2	0.2
11	4/8/2004	0.3	0.3	circular	0.8	0	y	n/a	4/8/2004	0.3	n/a	0.4	0.4
12	8/26/2010	0.2	0.2	coronal	0.8	0	n/a	transverse	8/26/2010	0.9	0	0.5	0.5
13	3/9/2005	0.2	0.2	n/a	0.8	0	y	transverse	n/a	n/a	n/a	n/a	n/a
14	6/2/2005	0.2	0.2	coronal	0	0	n	n/a	6/2/2005	0	0.1	0.0-0.5	0.0-0.5
15	8/25/2011	0.1	0.1	coronal	0.5	0	n	transverse	8/25/2011	0.1	0	0.1	0.1
16	4/28/2010	0.3	0.3	n/a	0.95	0	y	n/a	4/28/2010	0.9	0	n/a	n/a

Pt ID	NP date	NP right lateral wall	NP left lateral wall	Closure pattern	NP palate elevation	NP anterior palate motion	NP Pssavant ridge	NP levator orientation	Speech VF date	VF palate movement	VF posterior pharyngeal movement	VF right lateral wall	VF left lateral wall
17	2/11/2010	0.2	0.2	coronal	0.9	0	y	transverse	2/11/2010	0.9	0	0.3	0.3
18	3/22/2006	0.3	0.3	n/a	0.8	0	n	n/a	3/9/2006	0.7	0	n/a	n/a
19	1/26/2012	0.3	0.3	coronal	0.7	0	n/a	transverse	1/26/2012	0.6	0	n/a	n/a
20	4/13/2011	0.1	0.1	coronal	0.2	0	n	transverse	4/13/2011	0.4	0.1	0.1	0.2
21	8/24/2011	0.2	0.2	n/a	0.5	0	y	transverse	8/24/2011	1	0	0.3	0.3
22	8/24/2007	0.2	0.2	coronal	0.7	0	y	n/a	8/24/2007	0.7	0	0.2	0.2
23	8/11/2010	0.4	0.4	coronal	1	0	n	transverse	8/11/2010	1	0	0.4	0.4
24	5/14/2008	0.3	0.3	n/a	0.95	0	n/a	n/a	5/14/2008	1	0	0.4	0.4
25	11/24/2010	0.2	0.2	n/a	0.5	0	n	transverse	11/24/2010	0.3	0	0.3	0.3
26	9/28/2011	0.3	0.3	sagittal	0.9	0	n/a	n/a	4/11/2012	0.8	0.1	0.3	0.3
27	3/10/2010	0.4	0.4	coronal	0.9	0	n	transverse	3/10/2010	0.9	0.1	0.4	0.4
28	2/10/2011	0.2	0.2	coronal	0.6	0	n/a	n/a	2/10/2011	0	0	0.2	0.2

Appendix E: Patient Data

Pt ID: 1

Nasal alveolar molding: N
Surgeries: sphincter pharyngoplasty, date: 5/2005; adenotonsillectomy, date: n/a; abdominal surgeries, date: n/a; gallbladder surgery, date: n/a; gallbladder revision surgery, date: n/a
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: Y, date: n/a
Adenoidectomy: Y, date: n/a
VPI surgery: Y
Furlow palatoplasty: N
Sphincter pharyngoplasty: Y, date: 5/2005
Pharyngeal flap: N
Speech therapy: n/a
Duration: n/a
Oral motor perceptual assessment: n/a
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
4/4/2001: no bulb changes; 2/23/2005: impression; 2/25/2005: deliver appliance, transfer bulb; 3/9/2005: modify bulb; 5/13/2005: adjust appliance (adapt left clasp), modify bulb
Appliance remakes: 2/23/2005: broken appliance (chewed up by dog)

Pt ID: 2

Nasal alveolar molding: N
Surgeries: tympanostomy with ossicular chain reconstruction and meatoplasty, date: 2/1/1996; typmanomastoideectomy with facial recess approach, date: 5/18/1999; cleft lip revision with reapproximation of orbicularis oris muscle, date: 6/29/1999; open septorhinoplasty with rib costochondral graft, date: 6/29/1999; cleft lip revision with secondary reconstruction of the columella and nose with local flaps, nasolabial flap to the alar base, correction of whistle deformity with multiple z-plasties and flaps, date: 4/3/2001; LeFort I, placement of distraction device, #1/#16 full bony impaction teeth removal, date: 6/19/2002; Closure of oronasal communication, date: 6/19/2002; Replacement of external fixation device for distraction osteogenesis, date: 7/16/2002; Left alveolar cleft reconstruction with palatoplasty, date: 7/9/2003; Closure of oronasal fistula, date: 7/9/2003; Osteotomy and repositioning of premaxillary segment, 7/9/2003; Right alveolar cleft reconstruction, date: 12/12/2003; Closure of oronasal fistula, date: 7/9/2003; Furlow palatoplasty, date: 6/20/2006; Sphincter palatoplasty, date: 8/31/2007
Lip repair: Y, date: 6/29/1999, 4/3/2001
Soft palate repair: Y, date: 6/20/2006
Hard palate repair: Y, date: 7/9/2003
Oronasal fistula: Y
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: Y
Furlow palatoplasty: Y, date: 6/20/2006
Sphincter pharyngoplasty: Y, date: 8/31/2007
Pharyngeal flap: N
Speech therapy: n/a
Duration: n/a
Oral motor perceptual assessment: n/a
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
7/7/2004: add tail, extend to base of uvula; 7/21/2004: mini bulb; 9/1/2004: modify bulb; 12/15/2004: modify bulb; 12/22/2004: recement band (#14 lost band); 6/15/2005: modify bulb; 8/3/2005: modify bulb; 9/7/2005: modify bulb; 12/28/2005: no changes; 8/16/2006: impression; 8/25/2006: deliver appliance; 9/20/2006: mini bulb, modify bulb; 12/20/2006: modify bulb; 9/5/2007: adjust appliance (remove bulb status post sphincter pharyngoplasty);
Appliance remakes: 8/16/2006: shifted teeth (Furlow on 6/20/2006 - appliance last checked on 12/28/2005)

Pt ID: 3

Nasal alveolar molding: n/a
Surgeries: Cleft palate repair, date: 1996; adenoidectomy, 4/3/1996; Lefort I, date: 5/14/2003; Maxillary distraction osteogenesis, date: 5/14/2003
Lip repair: N
Soft palate repair: Y, date: 1996
Hard palate repair: Y, date: 1996
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: Y, date: 4/3/1996
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: N
Duration: n/a
Oral motor perceptual assessment: n/a
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
1/19/2005: exam; 1/28/2005: fit bands, impression; 2/9/2005; deliver appliance; 3/30/2005: adjust appliance (bent clasp); 4/1/2005: exam (traumatic ulcer associated with obturator cleft); 4/6/2005: add tail, extend to base of uvula; 5/13/2005: add mini bulb; 6/1/2005: modify bulb; 8/3/2005: modify bulb; 10/19/2005: modify bulb; 2/15/2006: modify bulb; 5/17/2006: modify bulb; 6/26/2006: recement band; 8/16/2006: modify bulb; 12/20/2006: modify bulb; 2/7/2007: reimpression; 2/21/2007: deliver appliance, bulb transfer; 4/18/2007 : modify bulb; 8/15/2007: no bulb changes ; 12/5/2007: modify bulb; 5/21/2008: no bulb changes , reline appliance (alveolar growth); 9/3/2008: no bulb changes ; 12/17/2008: reline appliance, modify bulb (reduced 2x2 left lateral area); 5/20/2009: no bulb changes ; 9/23/2009: reimpression; 10/1/2009: deliver appliance, bulb transfer; 1/20/2010: modify bulb; 7/7/2010: reline appliance, no bulb changes ; 4/20/2011: modify bulb; 9/30/2011: reimpression, add clasp (broken left clasp); 2/15/2012: delivery appliance, bulb transfer, modify bulb
Appliance remakes: 2/7/2007: broken appliance (fractured clasp); 9/23/2009: broken appliance (broken clasp)

Pt ID: 4

Nasal alveolar molding: N
Surgeries: None
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: Y, date: 6/2002
Adenoidectomy: Y, date: 6/2002
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: started 6/2002
Oral motor perceptual assessment: Open mouth posture, anterior teeth end-to-end, secondary palate is mobile.
Motor speech perceptual assessment: Placed tongue on articulator contact points
Obturator fabrication appointments:
7/30/2008: exam; 9/17/2008: fit bands, impression; 10/1/2008: deliver appliance; 11/5/2008: recement bands, add tail, adjust appliance (clasps distorted), extend toward soft palate; 11/19/2008: add tail, adjust appliance (clasps distorted), extend towards base of uvula; 2/4/2009: adjust appliance (right clasp distorted), mini bulb; 4/1/2009: adjust appliance, bent pharyngeal bulb anteriorly; 5/20/2009: adjust appliance (removing acrylic incisors), modify bulb; 6/17/2009: adjust appliance (clasps distorted), modify bulb; 7/15/2009: modify bulb , 12/2/2009: modify bulb; 4/21/2010; modify bulb , (small reduction 4 x 4 mm patch on posterior aspect of bulb); 8/4/2010: modify bulb , (small reduction 3 x 3 mm patch on posterior aspect of bulb); 4/6/2011: repair appliance (fractured into 3 pieces), modify bulb , (reduction on posterior left aspect of bulb);
Appliance remakes: None

Pt ID: 5

Nasal alveolar molding: N
Surgeries: Furlow palatoplasty, date: 1/22/1999; Tracheostomy, date: 11/19/1994; Lefort I, date: 6/2/2010; Hemiepiphysiodesis, date: 8/20/2009; Cleft palate repair, date: 1/1996; Mandibular osteotomy: 1/8/1997; Mandibular bilateral sagittal spilt osteotomy, 6/2/2010
Lip repair: N
Soft palate repair: Y, date: 1/5/1996
Hard palate repair: Y, date: 1/5/1996
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: Y
Furlow palatoplasty: Y, date: 1/22/1999
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: started 8/1997
Oral motor perceptual assessment: n/a
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
7/7/ 5/20/2005: exam, fit bands, impression; 5/27/2005: deliver appliance; 6/10/2005: add tail, extend toward soft palate (10mm); 8/19/2005: add tail, extend toward pharyngeal area; 8/18/2006: fit band, adjust appliance; 7/18/2007: reimpression; 1/7/2009: exam (re-evaluate VPI); 4/6/2011: impression; 5/11/2011: deliver appliance, add tail, extend 10mm against soft palate; 7/6/2011: add tail, extended 10mm against soft palate; 7/20/2011: mini bulb, add tail; 9/7/2011: modify bulb; 2/1/2012: modify bulb; 5/2/2012: modify bulb; 8/8/2012: modify bulb
Appliance remakes: 7/18/2007: growth

Pt ID: 6

Nasal alveolar molding: N
Surgeries: Gastrostomy tub placement, date: 2/1/2006
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started 1/27/2006
Oral motor perceptual assessment: n/a
Motor speech perceptual assessment: weak lip protrusion, mildly asymmetric retraction with left greater than right, protruded her tongue and achieved tongue-tip elevation to alveolar ridge, tongue lateralization was slow and effortful
Obturator fabrication appointments:
12/17/2008: exam; 1/5/2009: fit bands, impression; 1/16/2009: deliver appliance; 2/4/2009: add tail , extended 10mm distally to soft palate; 3/18/2009: add tail , extend toward soft palate (1mm distal, 2 layers of wax superiorly); 6/17/2009: mini bulb ; 9/2/2009: modify bulb; 12/16/2009: modify bulb; 3/3/2010: modify bulb; 10/6/2010: modify bulb (removed due to lost band); 1/5/2011: exam, add tail , posterior addition; 1/6/2011: fit band, adjust tail, relieved periuvular part of appliance; 3/16/2011: adjust appliance , relieved on palatal aspect along soft palate extension and palatal to maxillary second molars
Appliance remakes: None

Pt ID: 7

Nasal alveolar molding: N
Surgeries: bilateral herniorrhaphy, date: 11/20/1998; left tympanoplasty, date: 5/18/2004; sphincter pharyngoplasty, date: 1/5/2010; left tympanostomy tube, date: 1/5/2010; patch myringostomy, removal of left tympanostomy tube, date: 8/29/2012
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: Y
Furlow palatoplasty: N
Sphincter pharyngoplasty: Y, date: 1/5/2010
Pharyngeal flap: N
Speech therapy: Y
Duration: n/a
Oral motor perceptual assessment: n/a
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
7/2/2003: exam, impression; 7/18/2003: deliver appliance; 8/1/2003 : add tail, extend toward soft palate; 8/13/2003: add tail, extend toward soft palate (8mm); 9/17/2003: add tail, extend toward soft palate; 11/19/2003: add tail, extend to base of uvula; 12/3/2003: mini bulb; 1/7/2004: modify bulb; 1/21/2004: modify bulb; 2/18/2004: no bulb changes; 4/7/2004: recement band (#A loose band), no bulb changes; 7/21/2004: fit band (#A molar band), impression (re-make of clasps); 8/18/2004: deliver appliance, recement band (#A); 10/6/2004: modify bulb, adjust appliance (remove left clasp due to erupting permanent molar); 1/19/2005: impression, no bulb changes; 2/4/2005: deliver appliance, transfer bulb, modify bulb (reduced to help tolerate bulb); 2/11/2005: adjust appliance, (pharyngeal wire adjusted - was impinging uvula), modify bulb (reduced for comfort); 2/16/2005: no bulb changes; 3/16/2005: modify bulb; 5/18/2005: modify bulb; 8/17/2005: modify bulb; 11/16/2005: repair appliance (bulb and wire came off retainer part of appliance), modify bulb; 2/15/2006: no bulb changes , adjust appliance (adapt left clasp); 5/31/2006: adjust appliance (removed left clasp), lost band (#J); 6/7/2006: modify bulb; 10/4/20006: modify bulb; 3/7/2007: modify bulb; 8/15/2007: modify bulb; 1/2/2008: no bulb changes ; 6/4/2008: modify bulb; 11/19/2008: no bulb changes ; 6/3/2009: modify bulb
Appliance remakes: 7/21/2004: growth (eruption of permanent molars); 1/19/2005: growth (erupting permanent molars)

Pt ID: 8

Nasal alveolar molding: N
Surgeries: Furlow palatoplasty, date: 8/22/2000; sphincter pharyngoplasty, date: 12/4/2009; gastrostomy tube placement, date: 08/20/1999; bilateral preauricular tag removal, date: 08/20/1999; bilateral myringotomy and tympanostomy tubes, date: 08/22/2000; bilateral myringotomy and tympanostomy tubes, date: 12/15/2003; dental restorations and primary tooth extractions, date: 03/07/2005; gastrostomy tube removal: 2005, bilateral open slide Achilles tendon lengthening, date: 6/19/2008;
Lip repair: N
Soft palate repair: Y, date: 8/22/2000
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: Y
Furlow palatoplasty: Y, date: 8/22/2000
Sphincter pharyngoplasty: Y, date: 12/4/2009
Pharyngeal flap: N
Speech therapy: Y
Duration: Started 09/2002
Oral motor perceptual assessment: Class I occlusal relationship, secondary palate intact and mobile symmetrically, sphincter tissue was not visible on her posterior pharynx, suggesting it was well-placed in her nasopharynx. Mouth posture was closed.
Motor speech perceptual assessment: Place tongue on articulator contact sites, ancillary mandibular movement was accompanied tongue movements to the corners of her lips. Tongue movement was irregular when she attempted to circle her lips with her tongue. She protruded and pointed her tongue, but it rested on her lower teeth because she could not hold it independently. She puckered and retracted her lips, but had difficulty coordinating lip rounding with blowing.
Obturator fabrication appointments:
7/2/2012: exam, fit bands, impression; 7/9/2012: deliver appliance; 7/23/2012: add tail, mini bulb; 10/17/2012: modify bulb, repair appliance (cracked palatal acrylic near incisors)
Appliance remakes: None

Pt ID: 9

Nasal alveolar molding: n/a
Surgeries: cleft lip repair, date: 09/13/2002; bilateral myringotomy and tympanostomy tube, date: 02/07/2003; cleft palate repair (hard and soft), date: 02/07/2003; urethral dilation and cystoscopy, date: 12/21/2005; bilateral myringotomy and tympanostomy tubes, date: 07/25/2006; Furlow palatoplasty, date: 1/23/2007; tonsillectomy, date: 2/12/2008; bilateral myringotomy and tympanostomy tube, date: 1/18/2011; aveolar cleft repair, date: 05/24/2012
Lip repair: Y, date: 9/13/2002
Soft palate repair: Y, date: 2/7/2003, 1/23/2007
Hard palate repair: Y, date: 2/7/2003, 1/23/2007
Oronasal fistula: Y
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: Y, date: 2/12/2008
Adenoidectomy: N
VPI surgery: Y
Furlow palatoplasty: Y, date: 1/23/2007
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 19 months old
Oral motor perceptual assessment: intact palate without evidence of fistula. Minimal movement of soft palate, mild Class III malocclusion.
Motor speech perceptual assessment: Structure and function of tongue, lips and jaw were adequate to support fluent speech production
Obturator fabrication appointments:
9/14/2007: exam; 9/19/2007: fit bands, impression; 10/3/2007: deliver appliance; 10/17/2007: add tail, extend toward base of uvula (covers soft palate); 12/19/2007: exam; 4/16/2008: adjust appliance (not worn since 12/2007, shorten tail length), recement band (#A loose band), shorten in soft palate area; 5/7/2008: add tail, extend toward soft palate; 6/4/2008: add tail, extend toward base of uvula; 7/2/2008: mini bulb; 9/3/2008: modify bulb; 11/5/2008: modify bulb; 12/3/2008: no change to bulb; 3/4/2009: modify bulb; 6/3/2009: modify bulb; 7/1/2009: recement bands (#A and #J loose bands), exam, modify bulb; 11/4/2009: no bulb changes; 1/6/2010: modify bulb; 4/21/2010: no bulb changes; 4/29/2010: recement bands (#A loose band); 7/21/2010: modify bulb; 9/24/2010: recement bands (#A loose band); 1/5/2011: recement band (#A loose band), no bulb changes; 5/18/2011: recement bands (#A and #J loose bands), no bulb changes; 6/27/2011: recement bands (#A and #J loose bands); 7/20/2011: recement bands (#A and #J loose bands), impression; 8/1/2011: deliver appliance, bulb transfer; 8/18/2011: modify bulb (uncomfortable to eat), 1mm reduction on posterior surface of bulb; 9/21/2011: no bulb changes; 9/17/2012: impression; 9/24/2012: add tail, tail transferred, but pt unable to tolerate bulb transfer; 10/15/2012: mini bulb.

Appliance remakes: 7/20/2011: growth (erupting maxillary first molars); 9/17/2012: orthodontics (palatal expansion).

Pt ID: 10

Nasal alveolar molding: N
Surgeries: bilateral myringotomy and tympanostomy tubes, date: 5/29/2002; ankyloglossia release, date: 05/29/2002; Furlow palatoplasty, date: 05/29/2002; Orchiopexy and right inguinal hernia repair, date: 05/17/2007; palate lengthening surgery, date: 1/4/2008
Lip repair: Y, date: 9/13/2002
Soft palate repair: Y, date: 5/29/2002, 1/4/2008
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: Y
Furlow palatoplasty: Y, date: 5/29/2002
Sphincter pharyngoplasty: Y, date: 12/4/2009
Pharyngeal flap: N
Speech therapy: Y
Duration: n/a
Oral motor perceptual assessment: anterior open bite, secondary palate intact and minimally mobile, mouth posture was open.
Motor speech perceptual assessment: ancillary mandibular movements accompanied lateral tongue movements, he imitated tongue elevating and lowering after he was asked to keep his tongue inside his mouth, groping and facial movements accompanied lip pucker and retraction, but range of motion was adequate. he imitated multisyllabic words and phrases within the limits of his articulation.
Obturator fabrication appointments:
1/5/2011: exam, fit bands, impression; 1/26/2011: deliver appliance; 2/9/2011: add tail, extend toward soft palate (10mm); 3/2/2011: add tail, extend toward soft palate (10mm); 3/16/2011: mini bulb; 5/4/2011: modify bulb; 9/7/2011: adjust appliance (erupting #6/#13), modify bulb; 12/7/2011: modify bulb; 2/1/2012: modify bulb; 4/11/2012: modify bulb; 8/6/2012: deliver appliance; 8/27/2012: mini bulb; 9/5/2012: modify bulb; 11/7/2012: modify bulb .
Appliance remakes: 8/6/2012: lost appliance.

Pt ID: 11

Nasal alveolar molding: n/a
Surgeries: cleft lip repair, date: n/a; cleft palate repair, date: 7/2001; Furlow palatoplasty, date: 2003 (around 2yo); sphincter pharyngoplasty: 1/23/2004; adenotonsillectomy, date: 1/23/2004; dental restorations, date: 06/03/2004; Dental restorations and primary tooth extractions, date: 8/8/2006; cleft lip revision, date: 8/8/2006; bilateral myringotomy and tympanostomy tubes, date: 4/1/2008; calcium hydroxylapatite (Radiesse) injection into posterior pharyngeal wall, date: 4/1/2008; dental restorations, date: 5/22/2009; bone graft palatoplasty, alveolar bone graft, and closure of oronasal fistula, date: 5/22/2009; dental restorations, primary and permanent teeth extractions, expose and bond #8, date: 4/6/2012.
Lip repair: Y, date: n/a
Soft palate repair: Y, date: n/a
Hard palate repair: N
Oronasal fistula: Y
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: Y, date: 1/23/2004
Adenoidectomy: Y, date: 1/23/2004
VPI surgery: Y
Furlow palatoplasty: Y, date: 2003
Sphincter pharyngoplasty: Y, date: 1/23/2004
Pharyngeal flap: N
Speech therapy: Y
Duration: n/a
Oral motor perceptual assessment: n/a
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
5/5/2004: exam; 5/22/2009: fit bands, impression; 6/18/2004: deliver appliance; 7/7/2004: add tail, extend toward soft palate (8mm); 7/21/2004: add tail, extend toward base of uvula; 8/4/2004: mini bulb: 8/18/2004: modify bulb; 10/6/2004: modify bulb; 12/15/2004: no bulb changes; 5/18/2005: adjust appliance (adapt clasp), no bulb changes; 9/21/2005 : no bulb changes; 1/18/2006: modify bulb; 5/17/2006: no bulb changes; 9/20/2006: no bulb changes; 1/17/2007: adjust appliance (adapt clasp), no bulb changes; 5/16/2007: no bulb changes; 10/3/2007: no bulb changes; 2/6/2008: adjust appliance (remove clasps due to erupting max perm 1st molars), remove bands; 4/11/2008: modify bulb, 1mm circumferential reduction; 6/18/2008: no bulb changes; 10/15/2008: no bulb changes; 4/1/2009 no bulb changes; 7/15/2009: impression; 8/19/2009: bulb transfer, no bulb changes; 12/16/2009: no bulb changes; 2/17/2010: no bulb changes; 6/16/2010: no bulb changes; 12/15/2010: adjust appliance (adjusted acrylic against max left molars), no bulb changes; 1/19/2011: bulb transfer (to orthodontic retainer); 4/6/2011: no bulb changes; 8/17/2011: no bulb changes; 10/17/2011: adjust appliance (erupting #7); 12/7/2011: no bulb changes; 4/30/2012: adjust appliance (erupting #6 and #7, removed labial bow); 8/1/2012: no bulb changes.

Appliance remakes: 7/15/2009: palatoplasty and alveolar bone graft.

Pt ID: 12

Nasal alveolar molding: N
Surgeries: tonsillectomy, date: n/a; adenoidectomy, date: n/a; sphincter pharyngoplasty, date: 5/30/2003; sphincter pharyngoplasty, date: 12/19/2003; permanent tooth extractions (3rd molars), date: 1/2/2009
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: Y, date: n/a
Adenoidectomy: Y, date: n/a
VPI surgery: Y
Furlow palatoplasty: N
Sphincter pharyngoplasty: Y, date: 5/30/2003, 12/19/2003
Pharyngeal flap: N
Speech therapy: Y
Duration: n/a
Oral motor perceptual assessment: intact palate, sphincter was not visibile intra-orally, dental occlusion was within functional limits for speech production.
Motor speech perceptual assessment: place of articulation was accurate for all consonants
Obturator fabrication appointments:
12/15/2010: exam; 2/9/2011: fit bands, impression; 2/16/2011: deliver appliance, impression for maxillary ortho retainer; 3/16/2011: recement band (#3 loose band), add tail, extend toward soft palate; 5/4/2011: mini bulb, impression for mand ortho retainer; 6/1/2011: modify bulb; 10/5/2011: impression for maxillary ortho retainer & stop obturator use; 11/9/2011: deliver ortho retainer
Appliance remakes: None

Pt ID: 13

Nasal alveolar molding: N
Surgeries: Cleft palate repair, date: 7/2002; bilateral myringotomy and tympanostomy tube, date: 2/2002
Lip repair: N
Soft palate repair: Y, date: 7/2002
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 18 months old
Oral motor perceptual assessment: n/a
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
6/3/2005: exam; 8/19/2005: fit bands, impression, 9/16/2005: deliver appliance; 10/21/2005: add tail, extend toward base of uvula; 11/16/2005: add tail, extend toward base of uvula; 12/7/2005: mini bulb; 1/18/2006: modify bulb; 2/1/2006: modify bulb; 3/1/2006: modify bulb; 4/19/2006: modify bulb; 6/7/2006: modify bulb; 8/2/2006: modify bulb; 10/4/2006: modify bulb; 3/21/2007: modify bulb; 6/6/2007: no bulb changes; 10/17/2007: modify bulb; 12/19/2007: modify bulb (obturator not removed due to behavior); 4/2/2008: modify bulb; 6/18/2008: recement band (#J missing), impression; 7/2/2008: deliver appliance, bulb transfer; 9/3/2008: no bulb changes; 5/6/2009: no bulb changes; 10/21/2009: recement band (#A band came off), modify bulb; 1/20/2010: recement bands (#A loose band), no bulb changes; 7/7/2010: recement bands (#A loose band), no bulb changes.
Appliance remakes: 6/18/2008: growth (erupting maxillary first molars).

Pt ID: 14

Nasal alveolar molding: n/a
Surgeries: Cleft palate repair, date: 10/1998; Cleft palate repair, date: 2001; Furlow palatoplasty, date: 2001
Lip repair: N
Soft palate repair: Y, date: 10/1998, 2001
Hard palate repair: Y, date, 10/1998, 2001
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: Y
Furlow palatoplasty: Y, date: 2001
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 15 months old
Oral motor perceptual assessment: Imitating multisyllabic phrases within the limits of her articulation.
Motor speech perceptual assessment: Correct tongue and lip placement for most sounds.
Obturator fabrication appointments:
2/8/2006: exam, fit bands, impression; 2/17/2006: deliver appliance; 3/15/2006: add tail, extend toward soft palate; 4/14/2006: add tail, extend toward soft palate; 5/31/2006: mini bulb; 6/21/2006: modify bulb; 11/1/2006: no bulb changes ; 3/7/2007: no bulb changes ; 7/18/2007: no bulb changes ; 11/7/2007: modify bulb 3/19/2008; modify bulb; 7/16/2008: no bulb changes ; 11/19/2008: reimpression, remove clasps; 12/17/2008: deliver appliance, bulb transfer, add tail; 4/1/2009: modify bulb; 8/19/2009: modify bulb; remove clasps, remove bands; 11/18/2009: no bulb changes ; 3/17/2010: no bulb changes ; 7/21/2010: no bulb changes ; 5/4/2011: no bulb changes ; 11/2/2011: no bulb changes ; 5/2/2012: no bulb changes , reimpression; 7/16/2012: reline appliance; 11/14/2012: modify bulb
Appliance remakes: 11/19/2008: growth; 5/2/2011: post-orthodontics

Pt ID: 15

Nasal alveolar molding: N
Surgeries: muscle biopsy, date: 10/19/2005; gastrostomy tube placement, date: 2/6/2006; bilateral hip abductor and flexor releases, date: 9/30/2010
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 34 months old.
Oral motor perceptual assessment: Oral-motor exam revealed some labiofacial rounding; however, retracted was attempted at the eyes and not with the lips. Tongue-tip elevation and tongue lateralization side-to-side was adequate; however, there was no rotary movement present and tongue elevation movement was not differentiated from jaw movement. Reduced tongue control was also present, as Xander was unable to isolate and move his tongue to one side without it then moving to the other side. Significantly reduced oral-facial tone was present, resulting in an open mouth posture with tongue protrusion at rest. In addition, tongue protrusion persisted during all oral-motor and motor speech movements.
Motor speech perceptual assessment: Motor speech skills were characterized by reduced jaw control/stability, excessive jaw excursion, near-absence of labiofacial rounding and retraction, limited isolation of tongue placement, and overall reduced differentiation between articulatory musculature. Persistent tongue protrusion resulted in interlabial tongue placement for all bilabial consonants. In addition, all tip-alveolar, palatal, and velarconsonants were produced with forward tongue placement.
Obturator fabrication appointments:
9/26/2011: exam, impression; 10/3/2011 : deliver appliance; 1/9/2012: add tail, extend toward soft palate (4mm); 2/13/2012: add tai, extend toward soft palate (5mm); 3/12/2012: add tail, extend toward soft palate (6mm); 4/30/2012: add tail, extend toward soft palate (5mm); 5/21/2012: add tail, extend toward base of uvula (5mm); 6/18/2012: mini bulb; 6/20/2012: modify bulb.
Appliance remakes: None

Pt ID: 16

Nasal alveolar molding: None
Surgeries: None
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 3 years old
Oral motor perceptual assessment: Uvula monofid, bony palatal spine intact, secondary palate intact and mobile and elevated symmetrically, mouth posture was closing and breathing inaudible.
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
10/6/2010: deliver appliance; 12/1/2010: add tail, extend toward soft palate (10mm); 12/15/2010: add tail, extend toward soft palate (10mm); 1/19/2011: add tail, extend toward soft palate (10mm); 2/16/2011: add tail, extend toward base of uvula (9mm); 4/20/2011: mini bulb; 5/18/2011: modify bulb; 7/6/2011: modify bulb ; 10/16/2011: modify bulb.
Appliance remakes: None

Pt ID: 17

Nasal alveolar molding: N
Surgeries: Furlow palatoplasty, date: 5/25/2007; palatoplasty, date: 9/18/2009; gastrostomy tube placement, date: 02/28/2007; bilateral myringotomy and tympanostomy tube, date: 05/25/2007; closure of gastrostomy tube, date: 10/29/2010
Lip repair: N
Soft palate repair: Y, date; 5/25/2007, 9/18/2009
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: Y
Furlow palatoplasty: Y, 5/25/2007
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 22 months old
Oral motor perceptual assessment: Class I maslocclusion, persistent micrognathia and posterior tongue placement.
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
4/7/2010: exam; 4/14/2010: fit bands, impression; 5/5/2010: deliver appliance; 5/19/2010: add tail, extend toward soft palate; 6/16/2010: add tail, extend toward pharynx; 7/21/2010: add tail, extend toward most distal edge of soft palate; 8/18/2010: mini bulb; 10/6/2010: modify bulb; 10/12/2010: demonstrate appliance insertion and removal with mother (father previously only one able); 3/16/2011: modify bulb; 5/9/2011: remove band (loose band #J with popcorn kernel); 5/16/2011: recement band (#J), adjust appliance (adapt left clasp); 5/23/2011: recement band (#A band came off); 6/1/2011: modify bulb; 9/21/2011: modify bulb; 11/16/2011: no bulb changes; 3/14/2012: modify bulb; 6/13/2012: modify bulb; 4/17/2013: modify bulb.
Appliance remakes: None

Pt ID: 18

Nasal alveolar molding: N
Surgeries: Tympanoplasty (left ear), date: 5/11/2007
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: Y, date: 9/5/2006
Adenoidectomy: N
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 2 years old
Oral motor perceptual assessment: n/a
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
6/24/2006: exam; 9/5/2006: fit bands, impression; 9/22/2006: deliver appliance; 10/13/2006: add tail, extend toward soft palate; 11/3/2006: add tail, extend towards soft palate; 12/6/2006: add tail, extend to base of uvula; 1/3/2007: mini bulb; 1/10/2007: adjust appliance (distorted left clasp); 1/17/2007: exam; 1/26/2007: exam; 2/7/2007: exam, modify bulb, remove mini-bulb; 6/6/2007: add tail, extend towards base of uvula (6mm); 7/6/2007: mini bulb; 7/18/2007: modify bulb; 8/15/2007: modify bulb: 10/17/2007: modify bulb; 12/19/2007: modify bulb; 3/5/2008: modify bulb; 6/18/2008: modify bulb; 11/5/2008: modify bulb; 1/21/2009: reimpression (growth); 2/3/2009: bulb transfer; 4/1/2009: modify bulb; 6/17/2009: modify bulb; 8/19/2009: modify bulb; 11/18/2009: modify bulb; 3/25/2010: reimpression (growth); 4/7/2010: modify bulb; 8/4/2010: modify bulb, adjust appliance (erupting maxillary lateral); 12/1/2010: adjust appliance (distorted clasp), modify bulb; 4/6/2011: modify bulb; 7/20/2011: adjust appliance (palatal to central and lateral), modify bulb (reduced small amount superior surface); 8/17/2011: modify bulb, reimpression (growth); 8/29/2011: deliver appliance, bulb transfer; 1/4/2012: modify bulb; 5/9/2012: modify bulb; 9/19/2012.
Appliance remakes: 1/21/2009: growth (erupting maxillary first molars); 3/25/2010: growth (alveolar development); 8/17/2011: growth

Pt ID: 19

Nasal alveolar molding: N
Surgeries: bilateral myringotomy and tympanostomy tubes, date: 07/30/2008; dental restorations and primary tooth extractions, date: 04/20/2009; Furlow palatoplasty, date: 05/15/2009; bilateral myringotomy and tympanostomy tube, date: 05/15/2009; bilateral myringotomy and tympanostomy tubes, date: 02/25/2011; sphincter pharyngoplasty, date: 02/25/2011
Lip repair: N
Soft palate repair: Y, date: 5/15/2009, 2/25/2011
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: Y
Furlow palatoplasty: Y, date: 5/15/2009
Sphincter pharyngoplasty: Y, date: 2/25/2011
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 2 years old
Oral motor perceptual assessment: intact palate without evidence of fistulae, soft palate was intact and mobile.
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
2/27/2012: exam; 3/5/2012: fit bands, impression; 3/19/2012: deliver appliance; 4/9/2012: add tail, extend toward soft palate; 4/23/2012: add tail, extend toward soft palate; 5/7/2012: mini bulb; 6/13/2012: modify bulb.
Appliance remakes: None

Pt ID: 20

Nasal alveolar molding: N
Surgeries: adenoidectomy, date: 4/17/2007; left tonsillectomy, date: 4/17/2007; right partial glossectomy, date: 4/17/2007; left-sided bone anchored hearing aid (BAHA), 1st stage placement, date: 4/1/2011; left-sided bone anchored hearing aid (BAHA), 2nd stage placement: 8/2/2011
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: Y, date: 4/17/2007
Adenoidectomy: Y, date: 4/17/2007
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Active before 7 years old
Oral motor perceptual assessment: intact hard palate without evidence of fistulae, soft palate intact with minimal asymmetric movement with left greater than right, monofid uvula, limited lip rounding/retraction on the right secondary to the right facial palsy, good coordination of lip rounding/retraction both with and without voicing. reduced differentiation between tongue and jaw musculature.
Motor speech perceptual assessment: reduced differentiation between tongue/ jaw musculature, excessive jaw excursion, lateral jaw sliding, and asymmetric lip rounding and retraction.
Obturator fabrication appointments:
7/6/2011: exam, fit bands, impression; 7/20/2011: deliver appliance; 8/3/2011: recement band (#A came off), add tail, extend toward soft palate (10mm); 8/15/2011: recement band (replace #J band), add tail, extend toward soft palate (10mm); 9/19/2011: mini bulb; 11/2/2011: adjust appliance (adapt left clasp), modify bulb; 1/4/2012: repair appliance (incisor acrylic fracture repaired by grandfather (dentist)), modify bulb; 3/14/2012: recement bands (#J band came off), modify bulb; 4/18/2012: modify bulb; 5/9/2012: modify bulb .
Appliance remakes: None

Pt ID: 21

Nasal alveolar molding: N
Surgeries: Dental restorations and primary tooth extractions, date: 08/23/2010; Furlow palatoplasty, date: 10/19/2010; myringotomy and bilateral tympanoplasty, date: 10/16/2010; Dental restorations and primary tooth extractions, date: 5/23/2011
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: Y, date: 12/2008
VPI surgery: Y
Furlow palatoplasty: Y, date: 10/19/2010
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 2 years old
Oral motor perceptual assessment: Class II occlusal relationship, secondary palate intact and mobile symmetrically, mouth posture closed.
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
1/11/2012: exam, deliver appliance; 1/18/2012: add tail, adjust appliance (adapt clasps), extend toward pharynx; 1/30/2012: add tail, adjust appliance (adjust clasp), extend toward toward pharynx (10mm); 2/13/2012: mini bulb, adjust appliance (adjust clasps); 4/4/2012: modify bulb, recement band (#J), adjust appliance (adjust clasps); 6/6/2012: modify bulb; 9/5/2012: modify bulb, recement band (#A); 11/7/2012: modify bulb , removed bands.
Appliance remakes: None

Pt ID: 22

Nasal alveolar molding: N
Surgeries: ventricular septal defect repair, date: 09/2002; Dental restorations, date: 2006; palate repair, date: 03/2005; palatoplasty, date: 9/17/2003
Lip repair: N
Soft palate repair: Y, date: 9/17/2003, 03/2005
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: Y
Furlow palatoplasty: Y, 09/17/2003
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 3 years old
Oral motor perceptual assessment: Class III occlusal relationship, anterior open bite, absent maxillary incisors, Mouth posture was open, tonsils were moderate, and secondary palate was intact. Deep nasopharynx with a Passavant ridge during phonation.
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
10/3/2007: exam; 10/17/2007: fit bands, impression; 10/24/2007: deliver appliance; 11/7/2007: add tail, extend toward base of uvula; 12/12/2007: mini bulb; 3/5/2008: modify bulb; 8/6/2008: modify bulb; 10/1/2008: modify bulb; 6/17/2009: modify bulb; 10/21/2009: modify bulb; 3/3/2010: adjust appliance (remove clasps due to erupting molars); 6/30/2010: impression; 7/7/2010: deliver appliance, transfer bulb; 9/7/2011: no bulb changes ; 3/7/2012: impression (lost appliance); 4/9/2012: deliver appliance , extend to distal portion of palate; 5/7/2012: mini bulb; 6/20/2012: modify bulb; 12/5/2012: modify bulb .
Appliance remakes: 3/7/2012: lost appliance

Pt ID: 23

Nasal alveolar molding: N
Surgeries: sphincter pharyngoplasty, date: 5/9/2008; adenoidectomy, date: 5/2007; tonsillectomy, date: 8/2007
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: Y, date: 08/2007
Adenoidectomy: Y, date: 05/2007
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 18 months old
Oral motor perceptual assessment: intact palate without evidence of fistula, dental occlusion was within functional limits for speech production.
Motor speech perceptual assessment: age-appropriate place of articulation for all consonants
Obturator fabrication appointments:
10/20/2010: exam; 1/5/2011: deliver appliance; 1/16/2011: add tail, extend toward soft palate (12mm); 2/2/2011: add tail, extend toward soft palate (10mm); 2/16/2011: mini bulb; 4/20/2011: modify bulb; 5/16/2011: modify bulb (emergent visit), 0.5mm reduction in posterior portion; 7/20/2011: modify bulb; 11/2/2011: modify bulb; 2/1/2012: adjust appliance (reshape acrylic around posterior molars), modify bulb; 4/4/2012: repair appliance, no bulb changes ; 10/17/2012: remove bands, no bulb changes .
Appliance remakes: None

Pt ID: 24

Nasal alveolar molding: N
Surgeries: Dental restorations, date: n/a
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 18 months old
Oral motor perceptual assessment: anterior open bite and anterior maxillary edentulous spaces, mouth posture was open, tongue protruded symmetrically and rested on her lower lip.
Motor speech perceptual assessment: posterior tongue elevated during 'k' and 'g' production attempts, could not elevate her tongue tip to her alveolar ridge, lip retraction was adequate, but lip pucker was impaired, palate elevated symmetrically during phonation.
Obturator fabrication appointments:
6/18/2008: exam, fit bands, impression; 7/7/2008: deliver appliance; 9/3/2008: add tail , anterior stop behind max centrals for tongue stop and addition posterior along the soft palate displacing it superiorly; 2/3/2009: deliver appliance, anterior stop behind max centrals for tongue stop; 3/4/2009: add tail , Appliance #1: an addition was made to the appliance extending from the palate down towards the tongue to provide a tongue stop; Appliance #2: extend toward soft palate; 5/6/2009: add tail , anterior addition for tongue stop and posterior build-up for palatal lift.
Appliance remakes: 2/3/2009: lost appliance

Pt ID: 25

Nasal alveolar molding: N
Surgeries: None
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 2 years old
Oral motor perceptual assessment: palate elevated symmetrically at the appropriate distal-to-medial one-third, bony palatal spine was intact, mouth posture was closed.
Motor speech perceptual assessment: adequate.
Obturator fabrication appointments:
12/15/2010: exam, fit bands, impression; 1/19/2011: deliver appliance; 2/8/2011: recement band (#J); 3/9/2011: add tail, extend toward uvula (10mm); 5/18/2011: adjust appliance (clasp distorted towards cheeks), add tail, extend toward uvula (10mm); 6/15/2011: mini bulb; 8/3/2011: modify bulb; 11/16/2011: modify bulb; 12/7/2011: modify bulb; 2/15/2012: modify bulb; 3/7/2012: modify bulb; 5/9/2012: impression, repair appliance (add clasp for broken left clasp); 6/6/2012: modify bulb; 10/10/2012: modify bulb .
Appliance remakes: None (2/11/2013: lost appliance)

Pt ID: 26

Nasal alveolar molding: n/a
Surgeries: Cleft lip repair, date: 11/2000; Cleft palate repair, date: 7/2001; Alveolar bone grafting, date: 8/4/2010; Oronasal fistula repair, date: 2/12/2009, 7/28/2009, 8/4/2009, 8/19/2009, 9/17/2009, 8/5/2010; Comprehensive dental treatment, date: 4/9/2010; Nasolabial fistula repair, date: 6/3/2010.
Lip repair: Y, date: 2000
Soft palate repair: Y, date: 2004
Hard palate repair: Y, date: 2004
Oronasal fistula: Y
FAMM flap: Y
Tongue flap: N
Local repair: Y
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 8 years old
Oral motor perceptual assessment: small residual anterior fistula in avleolus, absent uvula, soft palate intact and mobile.
Motor speech perceptual assessment: within normal limits.
Obturator fabrication appointments:
3/5/2012: exam, fit bands, impression; 3/19/2012: deliver appliance; 4/4/2012: add tail, extend toward soft palate (10mm); 4/23/2012: mini bulb; 6/6/2012: modify bulb; 9/5/2012: modify bulb; 11/7/2012: reimpression (growth), no bulb changes ; 11/19/2012: deliver appliance, bulb transfer.
Appliance remakes: 11/7/2012: growth (partially erupted maxillary second molars).

Pt ID: 27

Nasal alveolar molding: N
Surgeries: Choanal atresia, date: 6/5/1998; Adenotonsillectomy, date: 2005
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 3 years old
Oral motor perceptual assessment: Minimal palate movement was noted with sustained /a/ production.
Motor speech perceptual assessment: Single-word articulation testing revealed only occasional substitution of /f/ for voiceless /th/. In connected speech, Austen demonstrated an increased rate and reduced articulatory precision and frequency of developmental substitutions increased.
Obturator fabrication appointments:
5/19/2012: exam, fit bands, impression; 7/7/2010: deliver appliance; 7/21/2010: add tail, extend toward soft palate; 8/4/2010: add tail, extend toward base of uvula; 10/6/2010: mini bulb ; 2/16/2011: modify bulb; 8/17/2011: reimpression; 9/12/2011: delivery appliance, bulb transfer; 11/16/2011: modify bulb; 5/2/2012: band removal, remove clasps, no bulb changes .
Appliance remakes: 8/17/2011:orthodontics (palatal expansion).

Pt ID: 28

Nasal alveolar molding: N
Surgeries: Comprehensive dental restorations, date: 5/18/2011
Lip repair: N
Soft palate repair: N
Hard palate repair: N
Oronasal fistula: N
FAMM flap: N
Tongue flap: N
Local repair: N
Tonsillectomy: N
Adenoidectomy: N
VPI surgery: N
Furlow palatoplasty: N
Sphincter pharyngoplasty: N
Pharyngeal flap: N
Speech therapy: Y
Duration: Started since 20 months old
Oral motor perceptual assessment: uvula monofid, secondary palata intact, hypodynamic palate, mouth posture open, tongue protruded in midline, lip pucker seemed limited, reduced lip retraction on his right.
Motor speech perceptual assessment: n/a
Obturator fabrication appointments:
3/9/2011: exam; 7/6/2011: deliver appliance; 8/3/2011 : add tail, extend toward soft palate (8mm); 10/5/2011: add tail, extend toward soft palate (4 mm), narrowed tail piece by 4mm; 11/7/2011: add tail, extend toward soft palate (5mm); 8/1/2012: add tail, cover hard palate, shortened to extend 4mm against soft palate.
Appliance remakes: None (1/28/2013: growth (partially erupted maxillary first molars))